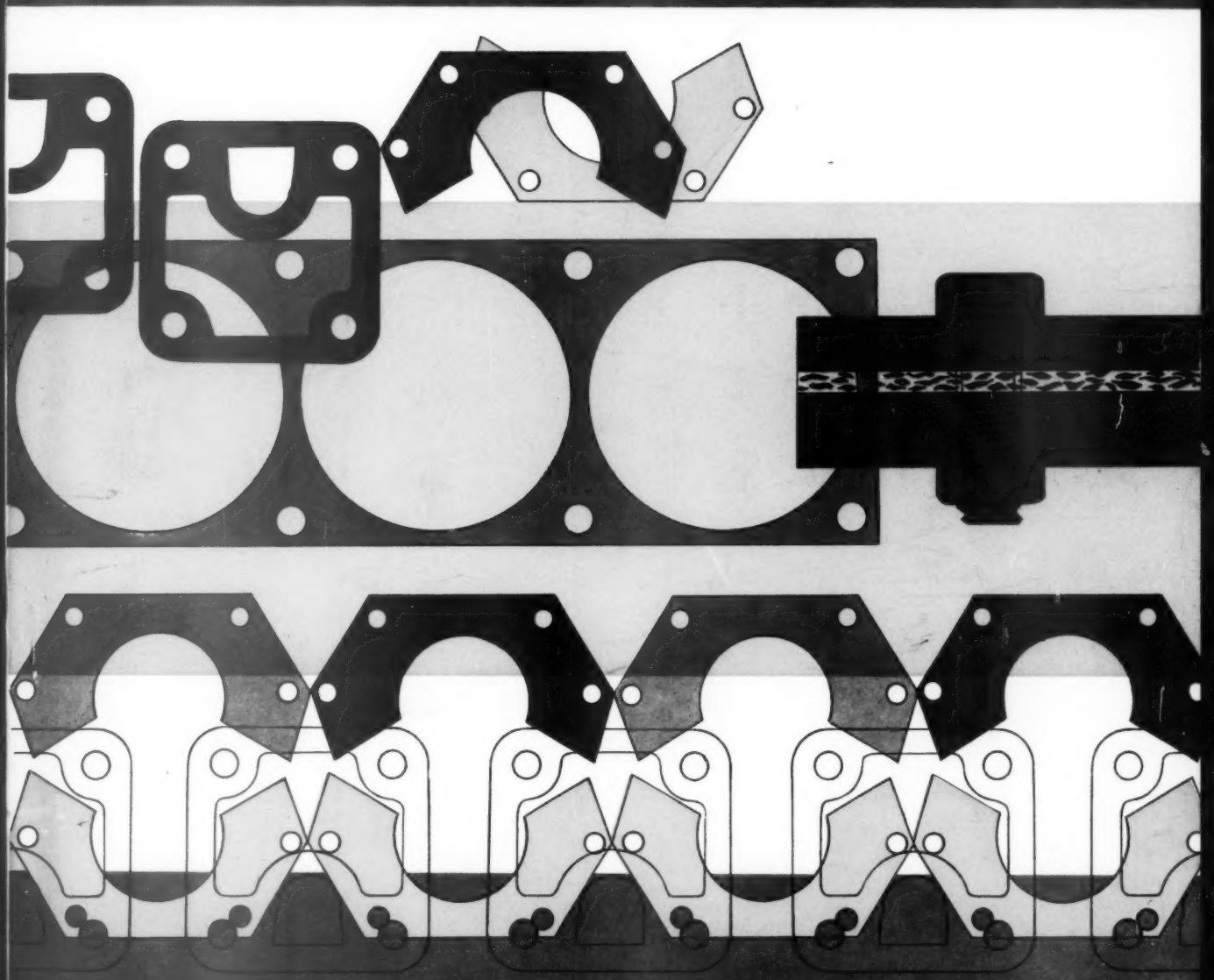
A HITCHCOCK PUBLICATION

assembly & fastener ENGINEERING

SEPTEMBER • 1961 • 50 CENTS



Retaining tension in gasketed joints

- Certification Procedure for Spot Welding
- Cutting Assembly Costs while Improving Quality

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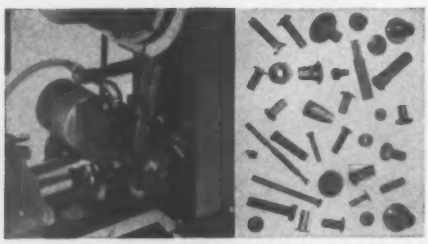

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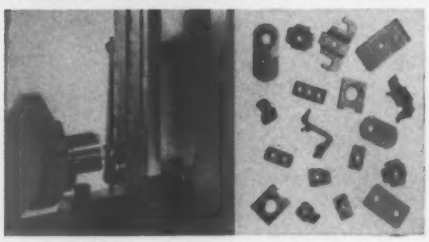

Taps 4000 per hour hand feed magazine. Capacity #0 to ⅜" fine pitch in mild steel.

A new horizontal version of the same operating principles long used in Snow vertical machines. Snow machines reduce changeover time, and cut tooling costs to a ridiculous minimum. On your next job, let us show you what the Snow method can do. Submit samples and prints.

Snow Manufacturing Company, Dept. C, 435 Eastern Avenue, Bellwood, Illinois (Suburb of Chicago)

SNOW

master fixtures save dollars and days in tooling costs

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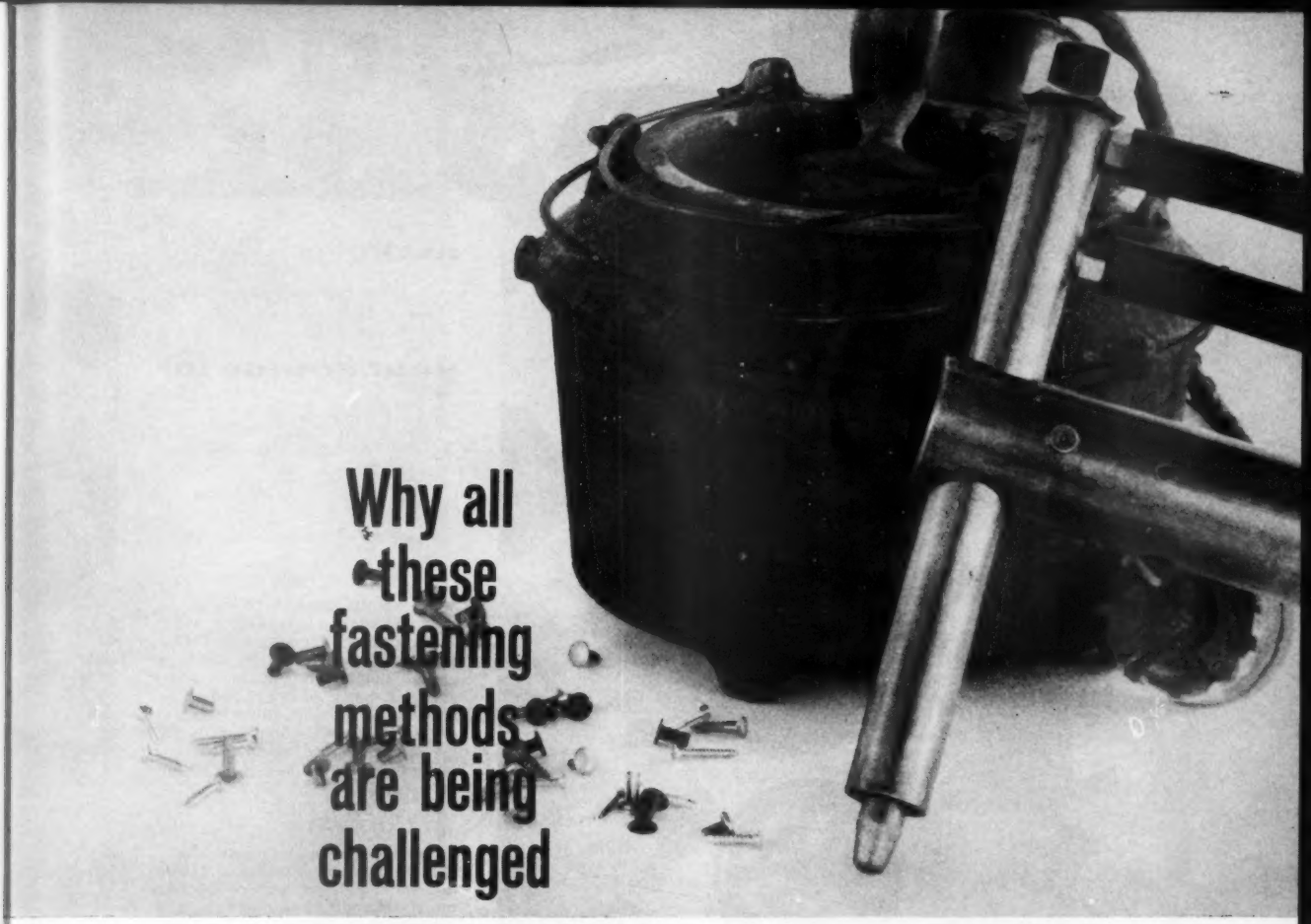

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Wire stitching is no cure-all. But, an objective analysis by men who know the most about it will tell if it is feasible for you. Simply return the coupon with samples of materials you wish fastened.

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Dept. ABW-91, 135th St. & Perry Ave., Chicago 27, Ill.
ATTENTION: WIRE STITCHING LABORATORY:

☐ Please furnish a complete analysis of wire stitching's potential in my operation—including savings potential, type equipment required and its estimated cost.

My present method is_____

Number of units per day_____

☐ Have Acme Idea Man call me for a preliminary discussion.

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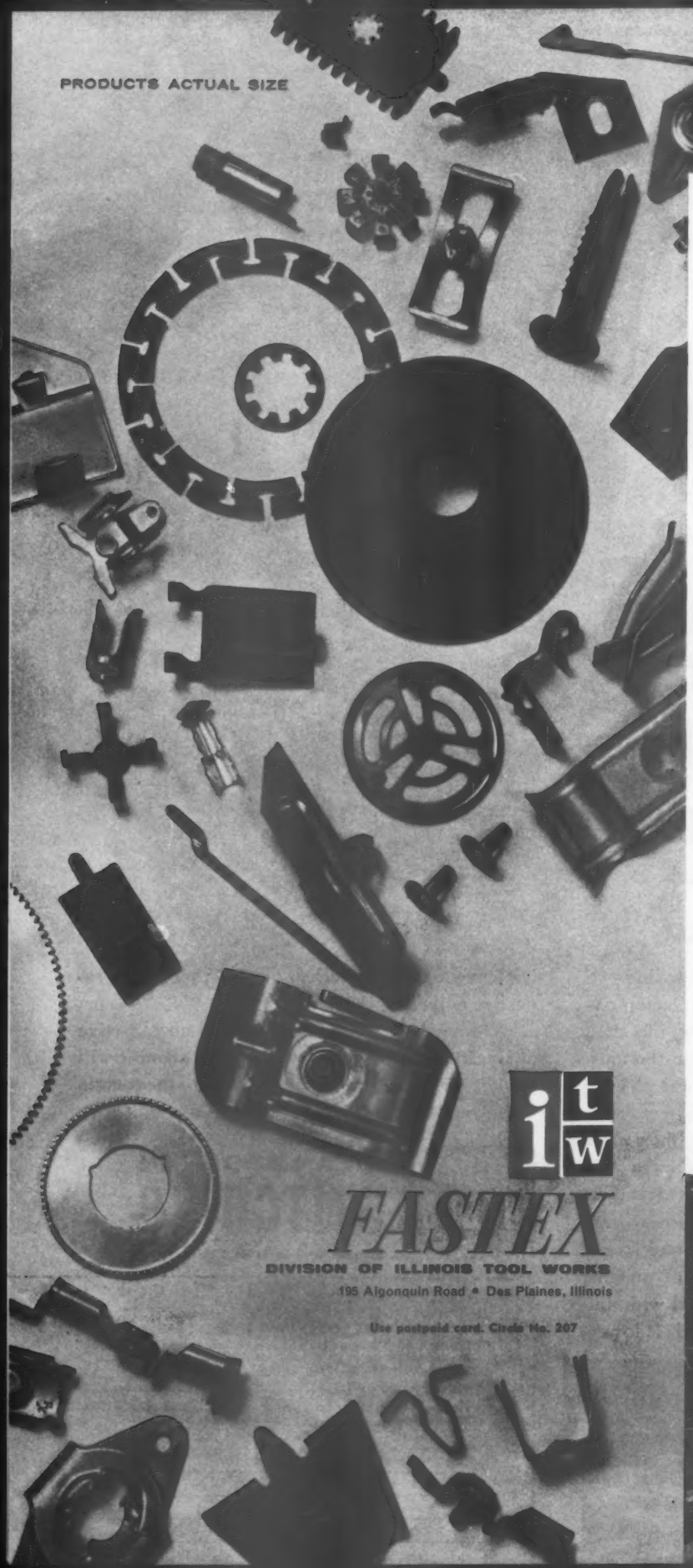
*Title*_____

*Firm*_____

*Address*_____

*City*_____ *Zone*____ *State*_____



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Precision tools are built in the Fastex completely equipped die shop.

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assembly & fastener ENGINEERING

BETTER DESIGN AND ENGINEERING FOR ASSEMBLY

Volume 4, Number 9 September, 1961

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BPA

LOOKING AHEAD

Among the articles coming up in the next few months are the following:

- Assembling TV Sets in Egland
- Effect of Zinc Plating on Fasteners
- Instrumenting the Ultrasonic Welder

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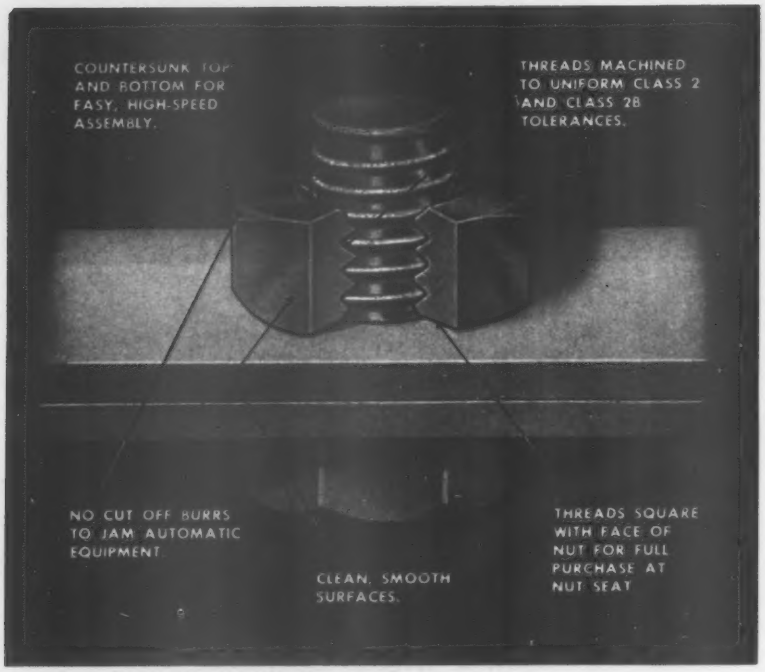
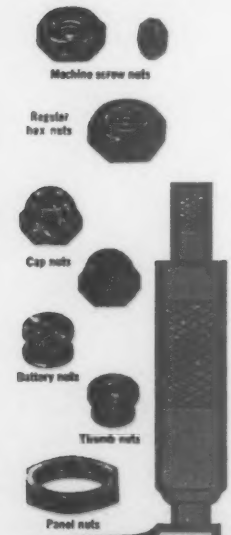

COUNTERSUNK TOP AND BOTTOM FOR EASY, HIGH-SPEED ASSEMBLY.
THREADS MACHINED TO UNIFORM CLASS 2 AND CLASS 2B TOLERANCES.
NO CUT OFF BURRS TO JAM AUTOMATIC EQUIPMENT.
CLEAN, SMOOTH SURFACES.
THREADS SQUARE WITH FACE OF NUT FOR FULL PURCHASE AT NUT SEAT

CORNELL

"Machined from the Bar" BRASS NUTS

REDUCE ASSEMBLY COSTS



"Machined from the Bar" brass nuts can save you countless production dollars yearly by speeding your assembly operations and reducing downtime and rejects to a minimum. These precision nuts handle easily, spin on smoothly, tighten securely and, once in place, *stay in place.*

We are specialists in *"Machined from the Bar"* brass nuts. *This is our only product.* Our method of manufacture assures that every nut is a precision product held to close tolerances and checked with go and no-go gauges. This uniformity speeds hand operations and permits trouble-free performance of portable and hopper-fed, high-speed nut setters.

Remember, *"Machined from the Bar"* brass nuts are available *at no extra cost.* Standards are available "off the shelf", shipped the same day the order is received.

Call, wire or write today: Gene Carroll, Yonkers 8-9400. Teletype, Yonkers 4356.

Remember . . ."Machined from the Bar" at no extra cost!

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Letters to the Editor

Automation and Employment

I would like to compliment you on your editorial in the August issue entitled, "A Look at Automation vs. Human Obsolescence".

We in the plastic business are especially aware of this situation because without automation we could not exist and turn out products at a price which the public would be willing to pay.

I believe that the very growth of our industry is proof enough of the message that you are trying to get across—that automation does create more jobs.

Melvin Hare, President
Lone Star Plastics Co., Inc.
Fort Worth, Texas

Welding Thin Gages

I would appreciate very much receiving information pertinent to thin gage continuous welding and mesh screen butt welding.

The facts mentioned in the article which appeared in your May 1960 issue were very interesting. We believe this technique could prove very useful in our applications. Consequently, we would appreciate it if you could supply us with information as to the equipment used to perform this type of work.

Michael Grundfest, Pres.
& Director of Engrg.
Actan Electronics, Inc.
New Hyde Park, New York

• Our suggestion is that you contact Airline Welding & Engineering Co., P.O. Box 70, Gardena, Calif., as the article is based on their work.

Rudy's Humorous Fasteners

In a recent issue in Rudy's humor column, you illustrated a screw with a "combination thread" as presented by Dumont Industrial Screw Co. Would you oblige me with the address of this company?

Edmond C. Crowther
Philadelphia, Penna.

• Dumont Industrial Screw Co. is located at 5920 Wilmington Ave., Los Angeles 1, Calif.

Furnace Brazing

Kindly send me one copy of the technical article, "Role of Joint Design in Furnace Brazing", which appeared in your May 1961 issue.

C. R. Lind, Vice Pres.
Andale Company
Lansdale, Penna.

• Reprints of this article are new available upon letterhead request.

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number 3 screwdriver

weighs only 12 ounces (just a few ounces more than a manual screwdriver). It delivers the famed Clecomatic accuracy to meet the most exacting production specifications.

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Application assistance, same-day service and cost-reducing quality make Holo-Krome THERMO-FORGED socket screws your best fastener buy. Like full details on how Holo-Krome quality and service can help increase your profit? See your authorized Holo-Krome distributor, or write for more information.

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SEPTEMBER, 1961, VOL. 4, NO. 9

NEEDED: DELIBERATIONS ON "CAUSE AND EFFECT"

One of the most timely industrial advertisements we have noted is the one being run in metalworking magazines by Pratt & Whitney. It is entitled "Industry's Fifth Column", and pleads for "customers who want to win the fight for survival".

While this advertisement is directed to the users of cutting tools, its message is just as apropos to the users of assembly equipment and fastening materials. Here is the opening paragraph:

"Tunnel vision! Restricted outlook! Tunnel vision acts as a fifth column. It causes management to see only the balance sheet and ignore the pressing need to retool. It causes labor to picture only pay hikes without compensating productivity. It causes government to kill, with unrealistic depreciation allowances, the goose that lays its golden tax eggs. It's later than we think."

The advertisement then comments on the fallacy of buying on price alone, pointing out that you defraud yourself with such a practice. It concludes with, "In your fight for survival you need the finest weapons."

This message may appear ultra-dramatic to some, just because we are not actually engaged in a shooting war.

But who can deny that economic war in the world markets cannot have just as disastrous results. However, "tunnel vision" is keeping too many of us from realistically viewing the facts. Our only concern is adding more padding to our soft life.

Management would rather give across-the-board pay hikes than take a chance on a strike to hold the cost line; immediate profits are the only concern. Labor would rather get a hike in pay today than be concerned about tomorrow's breadlines when the recalcitrant consumer has turned to lower priced imports. Our congressmen find it easier to ignore or pigeonhole measures to liberalize our depreciation laws than to think through the consequences of decadent industrial equipment.

We supposedly are the most enlightened nation on the earth, yet we refuse to seriously deliberate upon the law of "cause and effect". Consequently, in this economic war we are our own worst enemy.

Matt E. Hewett

Editor

WE BROKE A DOZEN SCREWS, BUT

we couldn't make this sheet metal insert spin in its hole!

THE INSERT PROBLEM

A hole punched in thin sheet metal doesn't provide enough surface for threading. You often have to supply the threads by installing an insert.

But the same hole doesn't provide much surface for *gripping*, either. The insert spins.

WHAT WE DID ABOUT IT

The insert we tested was designed with an *angular* knurl around a cone-shaped gripping perimeter. Here's what happened:

First: When we mated the sheets, put in a screw, and tightened it in the insert, the screw pulled the insert toward the sheet. It also pulled the teeth of the angular knurl more firmly into the edges of the hole, increasing their resistance to spin.

We broke screws (No. 8, 10, 12, and ¼ sizes) by overtorquing them. But the only effect on the insert was to tighten it.

Second: When the insert was first pressed into the hole, the angular knurl displaced metal, squeezing it toward and into a groove around the bottom of the insert. This locked the insert against being pushed out before the screw was tightened. After tightening, the lock was intensified by the added squeezing pressure of the angular knurl.

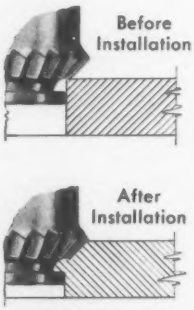
WE'LL SEND SAMPLES

If you've had this insert problem, drop us a line on your letterhead. We'll send some Southco THREDS (that's their name) for you to try. No obligation, of course. Write Southco Div., South Chester Corporation, 257 Industrial Highway, Lester, Pa.

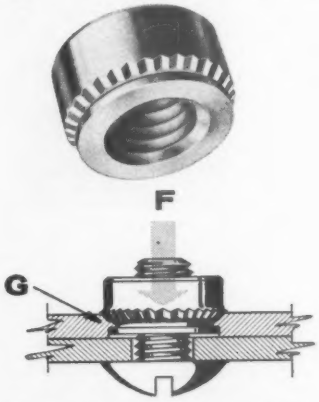
THREDS . . . AND THE ANGULAR KNURL PRINCIPLE

Southco THREDS are installed by pressing into a single hole in the sheet, provide thread length equal to or greater than that of a standard nut. One insert fits any sheet thickness (see minimum requirement, last column in table below). Material is case hardened steel, Cad. plated per Fed. Spec. QQ-P-416 Type II, cl. 2, yellow iridite.

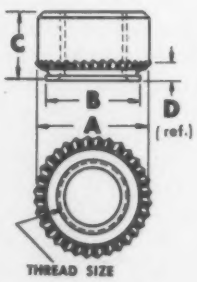
ANGULAR KNURL
(detail)



Teeth bite into edge of hole, force metal into locking groove at base of insert.



Additional torque on screw increases force F, pulling teeth of angular knurl more firmly against sheet and putting extra pressure on metal in locking grove G.



SOUTHCO THREDS[T.M.] . . . SPECIFICATIONS

THREAD SIZE	PART NUMBER	A	B	C	D	Weight per M (lbs.)	Min. Sheet Thickness
4-40 NC	74-11-104-13	7/32	.185	5/32	3/64	1.22	.035
6-32 NC	74-11-106-13	5/32	.247	5/32	3/64	1.89	
8-32 NC	74-11-108-13	3/16	.278	3/16	3/64	2.87	.048
10-24 NC	74-11-110-13	3/16	.278	3/16	3/64	2.51	
10-32 NF	74-11-210-13	3/16	.278	3/16	3/64	2.53	
12-24 NC	74-11-112-13	13/32	.372	3/16	1/16	4.56	.060
¼-20 NC	74-11-125-13	13/32	.372	3/16	1/16	4.28	
¼-28 NF	74-11-225-13	13/32	.372	3/16	1/16	4.32	

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AIDING DISTRESSED AREAS IN A GROWING ECONOMY

by **The Research and Policy Committee of the Committee for Economic Development**

High and stable employment is an essential goal of American life. Federal policies for many years have been directed toward that end. When a significant segment of the working population is unable to find employment over prolonged periods, America's productive strength is not fully used. This is an economic waste which the nation can ill afford.

As a nation, we have accepted a high and stable employment as a proper and necessary goal. Many groups in a community, in addition to its unemployed workers, have a strong interest in maintaining high employment and providing for economic growth.

The objective of effective assistance must be to help people to help themselves. Governmental participation should not infringe on the freedom of individuals or of business firms. To the greatest extent possible, it should facilitate and encourage the processes of freedom of movement and of a free market.

A detailed economic development program based on sound research and diagnosis should be prepared for each distressed area. Such programs may assist existing industries to expand employment, and may help attract new industries. They should realistically state the extent of the present and prospective need for workers to find jobs outside the area.

If the prospects for expanded employment are relatively poor, then a frank acceptance of the need to encourage out-migration is necessary. Far from providing additional hardships for the inhabitants of the area, this is the best way to encourage people to seek the greater opportunities which lie elsewhere.

Management and labor organizations should contribute to long-run employment opportunities by cooperative efforts to reduce labor and other production costs.

Lower costs can make possible more competitive pricing, entry into new markets and increased production volume, which will expand employment.

Management should exert every effort to develop new products and new markets. Employment opportunities depend as much on sound individual leadership in the local economy as on any combination of government programs.

Workers and their bargaining agents have a responsibility, in cooperation with employers, to work out labor conditions that will result in high labor productivity and competitive labor costs. This is a responsibility of workers to workers, who are the chief victims of excessive unemployment.

Management also has a responsibility in these situations. It is to use labor efficiently. The efficiency of plant layout and operation is a management responsibility and the skill and progressiveness of management in this regard is fundamental.

In a free enterprise system, no one can take from the business leader his obligation to continually seek for new ideas on how to use the resources at his command. When he fails, both his firm and his community suffer.

An adequate system of public education should be provided as the basic step in helping people to qualify for employment. It is also an essential step in enabling people to grasp the opportunities and meet the responsibilities of citizenship.

Vocational training programs in distressed areas should prepare people for jobs in the regional or national labor market as well as for openings in the local labor market.

In the next decade, the occupational pattern of the labor force is expected to shift toward higher proportions of professional and skilled persons. This in turn calls for a higher degree of education and specialized training in our work force. As a continuation of the trends in the past decade, the greatest increase, about 41%, will be in the numbers of professional and technical persons.

There is little doubt that the students benefit from vocational education. Employers prefer to hire people with such training rather than those without. Most graduates of vocational training go to work in jobs related to their training. Vocational educators do not claim

continued

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...to
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Cotter Pins
Precision made Hindley Cotter Pins speed assembly because they are uniform and free of burrs. Available in a wide range of metals, shapes and sizes. Write for folder.
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Wire Hardware • Cotter Pins • Plumbing Specialties
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that school training alone makes skilled workers. It provides the essential groundwork for developing skills.

An important recent trend is the development of area vocational schools. These schools are intended to provide the facilities and specialized curriculum that would not be possible for very small school districts.

Some of this trend toward area vocational schools has been related to the problems of persistent labor surplus areas and their desire to attract new industry. A prospective industry also may be interested in the long-run advantages of training programs in the area to supply future skilled workers. The programs could provide industry employees supplementary extension courses, also.

The state employment agencies should, in cooperation with the United States Department of Labor, make more information available in chronic unemployment areas about job opportunities in other parts of the country. A matching of skills in surplus supply in depressed areas with shortages of the same skills in prosperous communities would be of benefit to both unemployed workers and to employers.

A program of active experimentation to determine how the Employment Service can effectively provide information to workers in labor surplus areas about employment opportunities elsewhere is recommended.

Each Federal Reserve Bank should establish a Federal Reserve Development Corporation to assure adequate financing for sound business ventures and necessary public facilities in distressed areas. Such a corporation should be used only where their resources are needed to supplement other local or statewide effort.

There are dangers in an expanded Federal loan program. Political pressures may force a broad definition of loan eligibility. Broad definitions spread assistance thin and reduce what little advantage a loan program would provide.

To safeguard the taxpayers' money, the loan agency may have to insist on collateral far beyond that required by a regional or private group. Moreover, the loan agency could not take an equity position. This is often a primary requirement for successful risk financing. Loads or guarantees should be provided only as a part of a sound local development program.

Further research into the nature, cure and prevention of area-wide chronic unemployment is necessary.

One goal of such research should be the development of an early-warning system which could indicate potential danger areas not now suffering from chronic high unemployment.

Among the topics to which attention should be given are:

What does the latest census and other existing data reveal about the population characteristics of these areas? What are the reasons why out-migration has not been greater?

What does economic analysis of industrial location decisions indicate about the requirements of various kinds of industries and firms?

What shifts in industrial location and requirements of various industries are taking place?

What shifts in employment requirements of various industries are taking place?

What additional assistance can Federal agencies give distressed areas within existing programs?

Would a more regular reporting of labor market conditions in smaller labor markets be feasible and worth the cost?

Periodic reports on some of these subjects, combined with more detailed information and forecast for individual areas might provide the basis for an early-warning system. Communities would be alerted to the possibility of a prolonged labor surplus.

With an effective system, individual workers, businesses, and community leaders may be able to make adjustments with reasonable speed. •

The data for this article was compiled from the report "Distressed Areas in a Growing Economy." This report was issued by the Committee for Economic Development's Research and Policy Committee in June, 1961.

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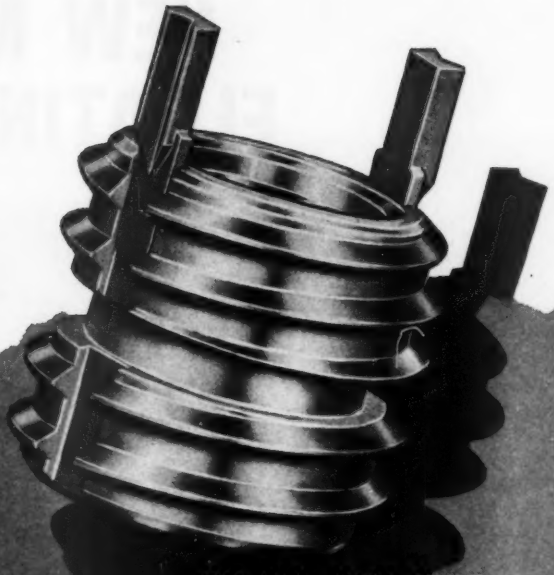

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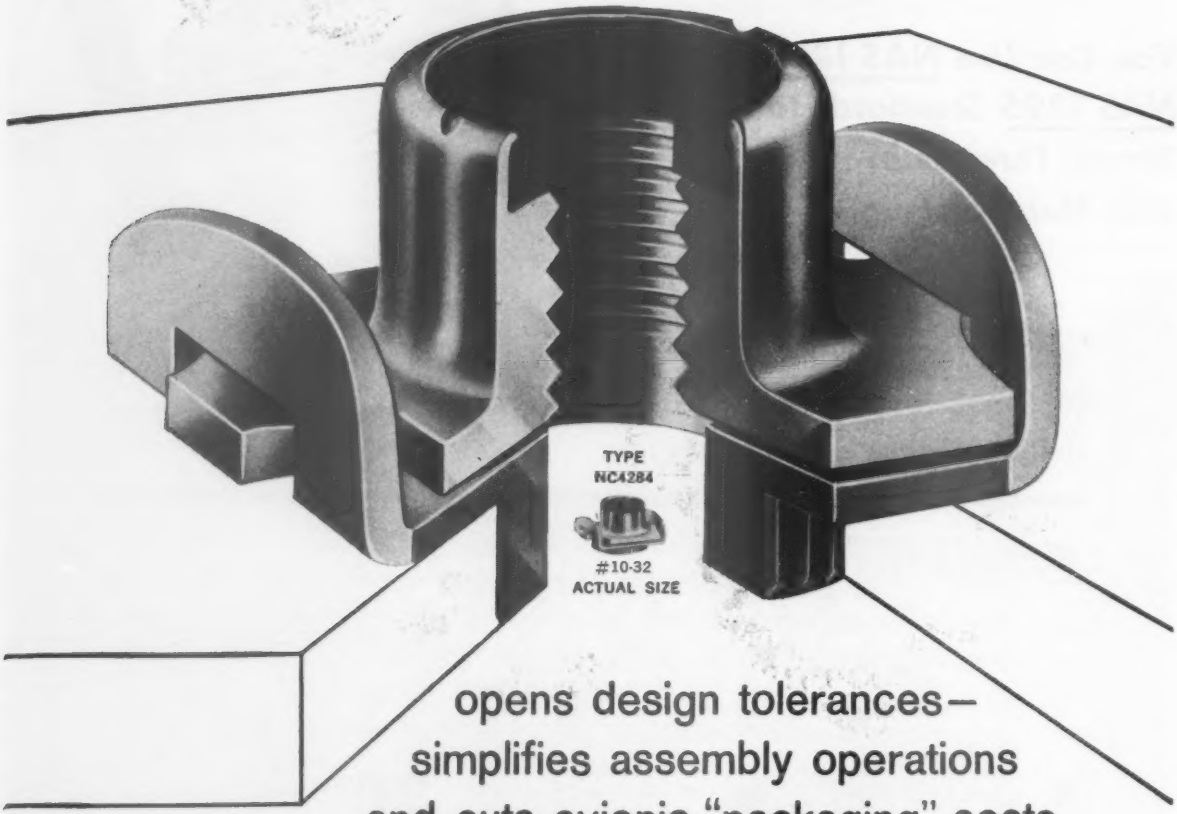
NEW MINIATURIZED FLOATING CLINCH NUT



opens design tolerances— simplifies assembly operations and cuts avionic "packaging" costs.

Standard ESNA
Non-floating
Clinch Nut Types

NC
250° F

NKC
250° F

NKCFM
250° F

MINIATURE

NCFMA
350°F

LHCFM
550°F

Here at last is a reduced-dimension clinch nut and basket assembly that provides .020″ minimum radial float. Because the nut is able to compensate for minor bolt hole misalignment in the component to be attached, production line techniques can be simpler and faster.

This very lightweight type NC4284 nut offers the electromechanical engineer new design opportunities in the assembly of electronic chassis, panels, cover plates and many other "packaging" applications. Due to its very narrow basket this fastener requires less flange width for installation than any other similar-purpose press or stake-in type part.

The retaining basket has a precisely knurled shank which standard ESNA punch and dolly tools firmly embed into aluminum or mild steel sheets, for maximum security against twist-out or push-out forces. The new fastener is easily installed in a drilled or punched hole using a regular drill or arbor press.

ESNA's exclusive red nylon locking insert gives this nut a consistent locking torque through more than 50 on/off cycles. It guarantees reliable fastener performance for assemblies that demand frequent disassembly for maintenance or inspection needs. Yet the smooth grip of the nylon collar will not flake cadmium plating from the bolts. The special formula nylon accepts temperature environments from −65°F. to 350°F.

This new floating clinch nut is designed in carbon steel—in sizes No. 4, 6, 8, and 10. Each thread size is available in 2 shank lengths of .040″ and .060″ for flush installation in sheets of equivalent or greater thicknesses.

For complete specifications and installation instructions on new part NC4284 and many other lightweight avionic fasteners, write Dept. 58-997 for a copy of the new Aerospace Catalog No. 960.

ELASTIC STOP NUT CORPORATION OF AMERICA

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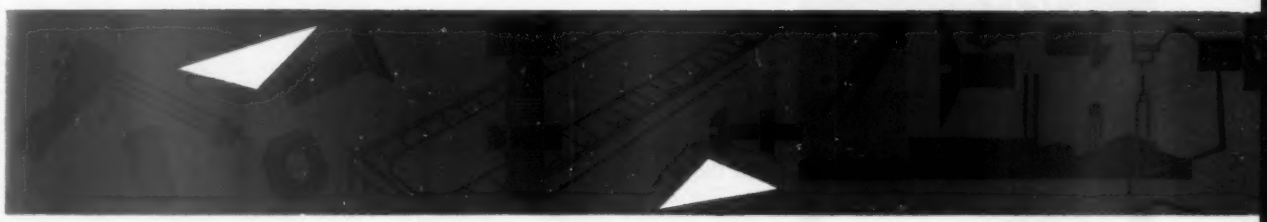
Ideas and Field Reports



POWER TOOL USED TO SPEED ASSEMBLY OF CYPRESS GARDEN GRANDSTAND

Above, one form of triangular frame sub-assembly. Note angle through which universal joint socket must operate to drive the six bolts that are in the same plane. Completed aluminum space frame grandstand (below) erected on pier at Cypress Gardens.

A 300-seat grandstand, designed by Up-Right, Inc., Berkeley, Calif., was assembled and erected by five men in two weeks.

The entire stand was bolted together, using impact wrenches made by the Skil Corporation.

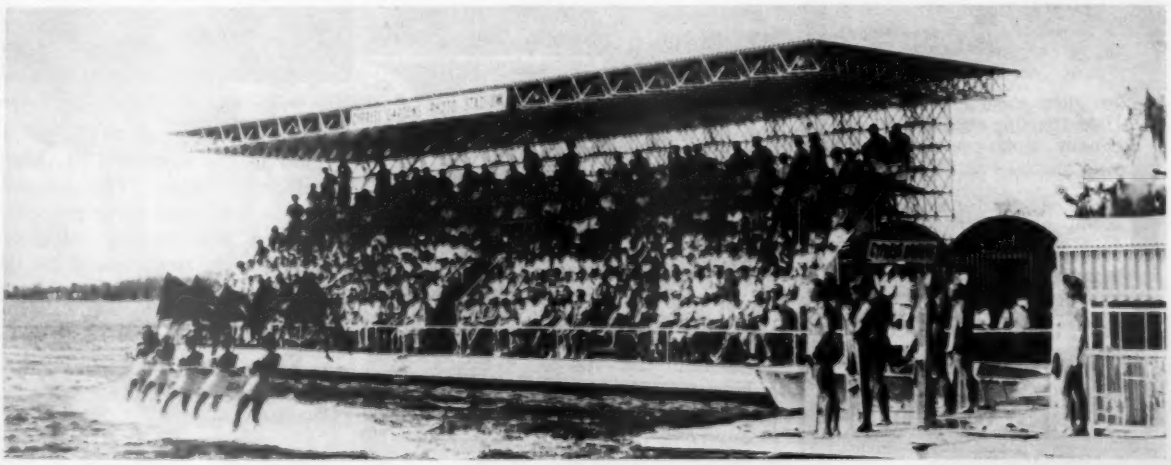
The structure was built for the Florida Cypress Garden Association, and is to be used for spectators and photographers viewing the Garden's water skiing events. It is 80′ long and 20′ wide, including canopy, seat frames, and back support.

It is assembled from octahedron and tetrahedron sections constructed from only two basic parts: 13,000 identical struts and 3,000 identical joints.

These thousands of struts and joints were assembled into sections at the site.

Skil's model 823 impact wrench, with a voltage control to lower the

continued



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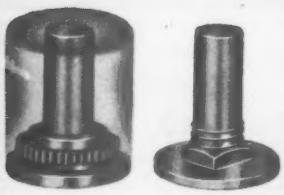

MILLED FROM BAR COLD HEADED

thanks to COLD HEADING by CLARK

THE PROBLEM:
Cut costs on a special fastener blank used as insert in plastic knob.

SPECIAL REQUIREMENTS:
Fastener must have surfaces that grip into plastic and hold fast when knob is pulled laterally or turned.

SOLUTION:
Redesign to simplify gripping surfaces. Production by Clark Cold Heading process (instead of machining from bar stock).

SAVINGS:
In steel ....$19.70 per 1 M pcs.
In labor, over 21.00 per 1 M pcs.
TOTAL, over $40.00 per 1 M pcs.

It's quite possible that Clark Cold Heading can effect equally impressive savings on *your* special fasteners.

Send sample (or blueprint) for prompt analysis and quotation ... *at no obligation.*

CLARK BROS. BOLT CO.
MILLDALE, CONN.

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impact voltage of the wrench to a lower factor, was used. The lower factor was for use with the small nuts and bolts.

By slowing the wrench down, the impact and therefore the magnitude of the applied torque was varied, depending on the size and strength of the fastener.

The entire structure weighs less than 10,000 pounds. The tubular struts and joints used are made of heat-treated aluminum alloy, natural satin finish, clear lacquer dipped. All hardware is stainless. The roofing is made of corrugated aluminum with a blue underside.

The octahedron-tretrahedron structures are a patented design of the Up-Right Company. They are suitable for a variety of architectural uses, such as portable octahedron towers which have been supplied to several electronic companies and the U.S. Army Signal Corps. Also, a tetrahedron space frame factory building was recently erected in Berkeley, Calif.

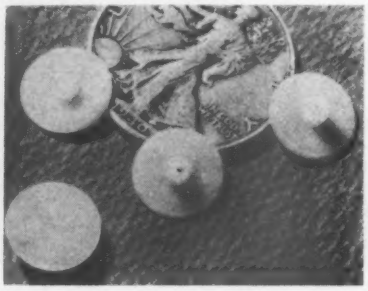
INSERT KIT SPEEDS SERVICING OF ENGINES

A kit assortment of stainless steel wire thread inserts is used for repairing worn, damaged or stripped threads in Clinton industrial air cooled engines. The kit is made by the Heli-Coil Corp.

Designed to aid small engine service facilities, the kit can also be used for replacing damaged threads of certain sizes in automobiles, machine tools and material handling equipment.

The three steps involved in repairing damaged threads are described and illustrated by line drawings and photographs on the inside cover of each kit.

DELRIN AIDS SMALL MECHANICAL ASSEMBLY



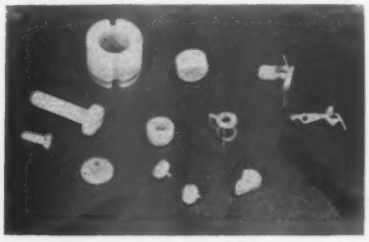
Molded disc-and-pinion combination used in Hamilton Watch automotive clock. The piece is 45° angle miter gear with 97 precision teeth.

Because of its combination of mechanical properties, duPont's acetal resin, Delrin, is ideal for small mechanical and electronic parts assembly.

One of the features of the plastic is its over-all "creep" resistance. It also has high tensile and flexural strength, good impact strength and high modulus of elasticity. It has an average flexural modulus of 410,000 psi.

Typical of the requirements met by the plastic is the small, combination disc-and-pinion used in Hamilton Watch Co.'s automobile clock. The disc measures .530" od x .036" thick. It has 97 gear tee on a 45° angle miter, with the tooth depth held to a high accuracy. This disc-and-pinion is the only plastic component in the clock movement. It is part of the automatic regulator transmitting intermittent motion to the sector gear.

Another use, showing dimensional stability, is the bearing and



This variety of tiny, precision parts were molded of acetal resin.

trunion in the Ronson CFL Mark II electric shaver. The trunion, mated to a pivoted drive pin, snap fits into the bearing which is mounted to the underside of the die cast cutter bar. The oscillation of the drive pin generates the reciprocating motion to the multi-blade cutter bar. The resilience of the plastic makes it ideal for the snap fit of these parts.

continued

Keystone Wire solves dairy brush forming and corrosion problems

Uniform wire softness is needed to perform brush twisting operations on high-speed twisting machines. To solve this problem, Keystone Steel & Wire Company developed for Regal Manufacturing Company, Fond du Lac, Wisc., a dead soft galvanized twisted Brush Handle Quality Wire. A special tight zinc coating is designed to adhere firmly during the severe twisting.

Regal Manufacturing Company specializes in making unusual brushes for the dairy and creamery industry—for example, the milking machine brush illustrated at left.

For filled brushes, galvanized stapling wire anchors crimped white nylon bristles into brush blocks of Super Hi-Impact plastic, hard rubber and hard wood. Regal uses Keystone's galvanized Stapling Quality Wire to resist corrosion from water and lactic acid.

These quality wires are products of Keystone's Metallurgical Laboratories. If you make brushes or other wire formed products and want to improve them, tell us about your wire needs. We shall analyze your requirements and make the necessary recommendations.

Keystone Steel & Wire Company, Peoria, Illinois

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WIRE FOR INDUSTRY

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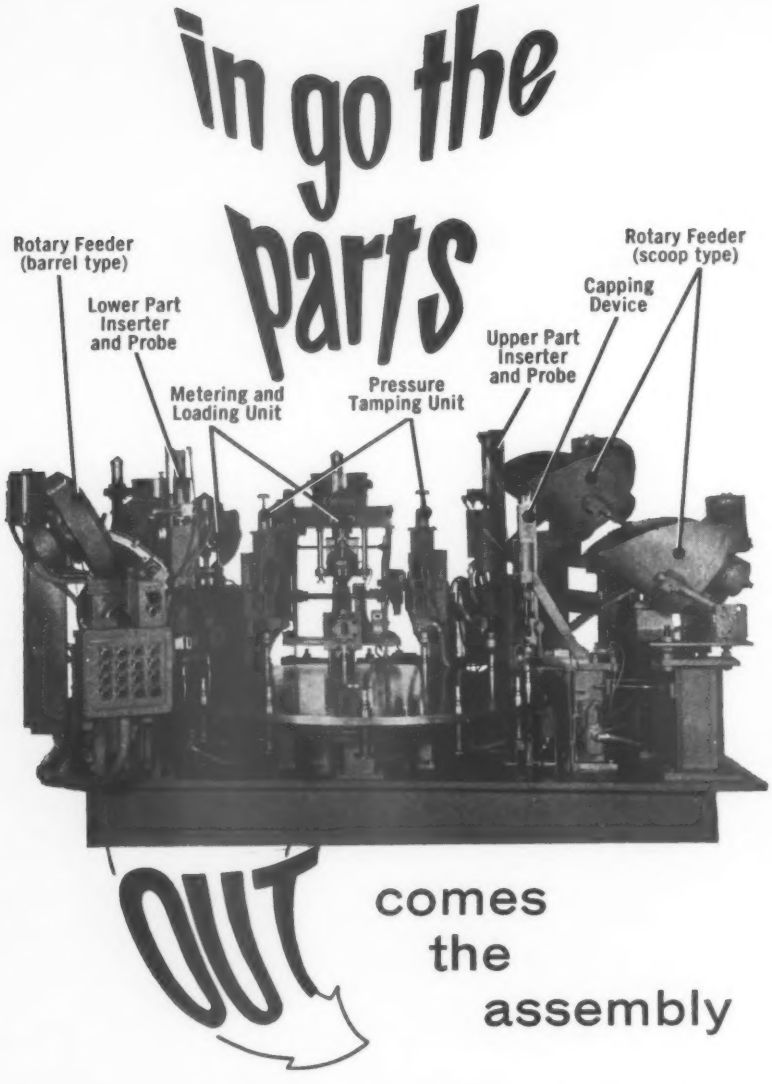

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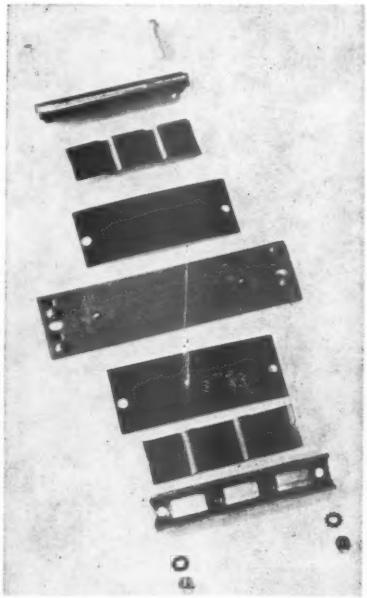
The fit is maintained in operation, despite the high speed reciprocating motion of the multi-blade cutter bar, which changes direction 14,400 times per minute.

These plastic parts, and others, including Delrin fasteners, were molded by the automatic single cavity molding method of Gries Reproducer Corp.

HIGHER-PRICED PART CUTS TOTAL ASSEMBLY COST



Eleven pieces formerly used in busway assembly were replaced by molded polyester spacer, cutting assembly time 50%, and reducing weight an average of 30%.

A simple design change in busway construction netted three major benefits recently for Electric Distribution Products, Inc., Allentown, Pennsylvania.

By switching from insulated metal brackets to more expensive one-piece polyester glass insulators for bus bar supports, the firm cut assembly time 50% and lowered the weight of the complete line by an average of 30%.

Although the spacers cost about 29% more, than the previously used metal brackets, a net savings was realized through increased assembly speed and lower shipping charges because of reduced weight.

Formerly, EDP used a bracket which consisted of about 11 pieces.

continued

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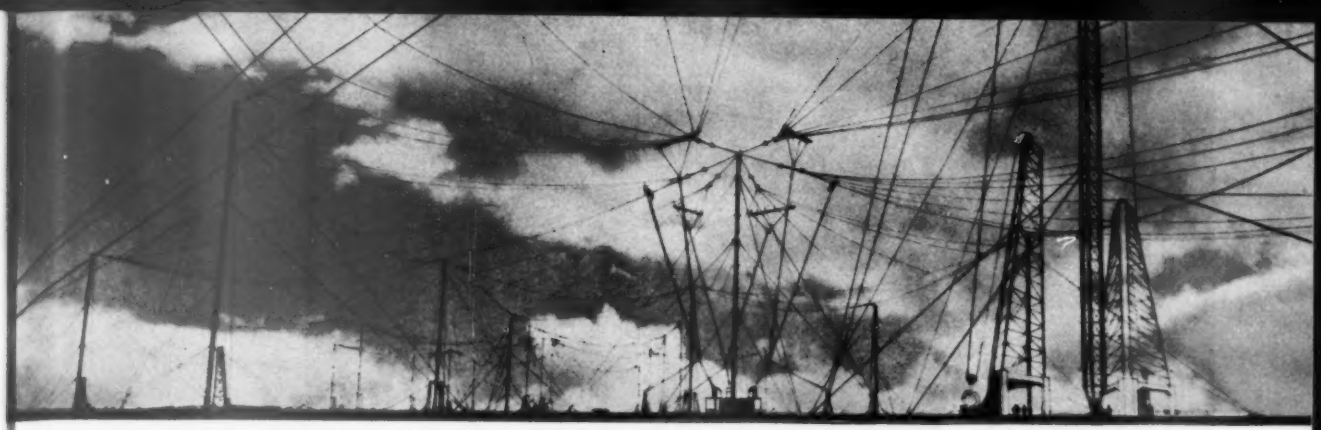
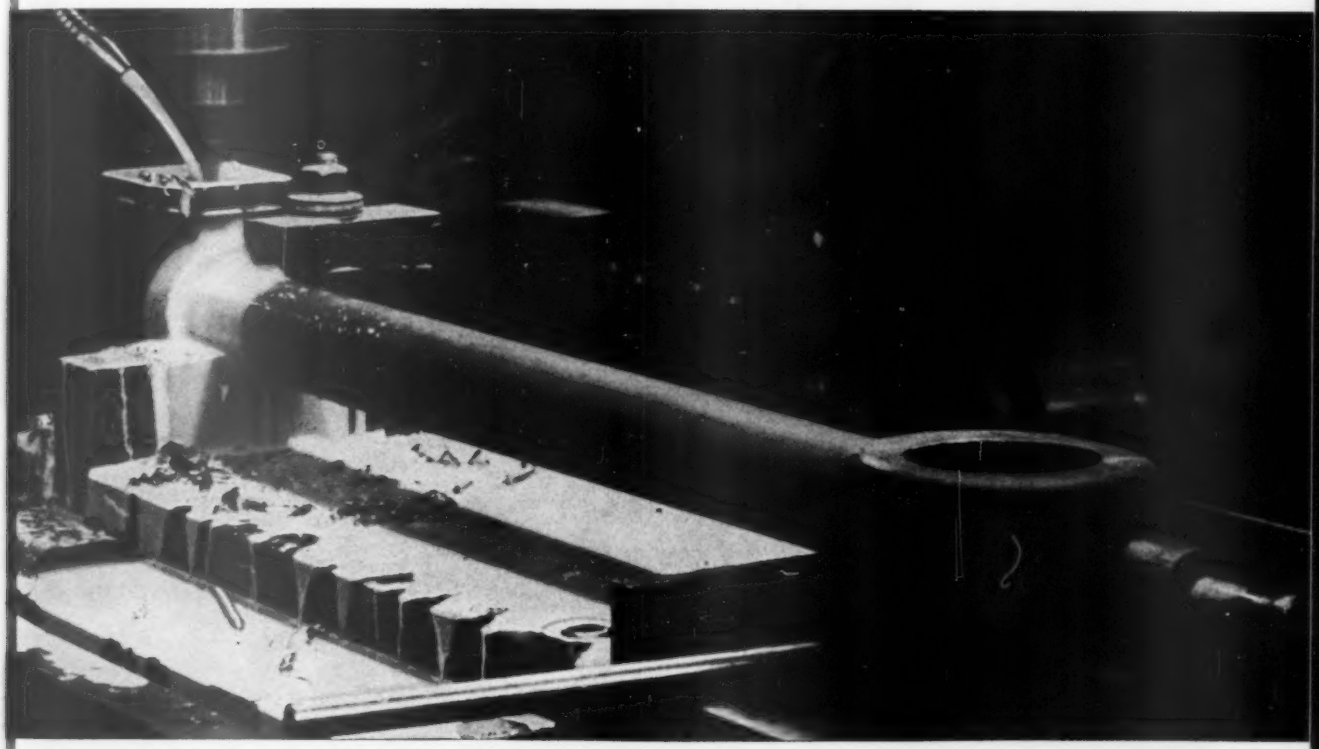


World's largest radio antenna contains 800 special Bethlehem eye-bolts



Husky eye-bolts, 800 of them weighing 75 lb each, are insulator-chain links guying the antenna of the most powerful radio station ever built. This specially engineered eye-bolt is typical of the special fasteners which Bethlehem manufactures in a wide variety.

This gigantic broadcasting station, located near Machias Bay on Maine's rock-bound coast, permits the U.S. Navy to reach submerged submarines half-way 'round the world.

Whether you need a tiny bolt with a special head . . . or a large-size "special" made to precise specifications, the chances are good that we can make it at an attractive price.

Just send a drawing or sketch of what you need, with a description of its application. Write or call the nearest Bethlehem sales office. Or get in touch with us at Bethlehem, Pa.

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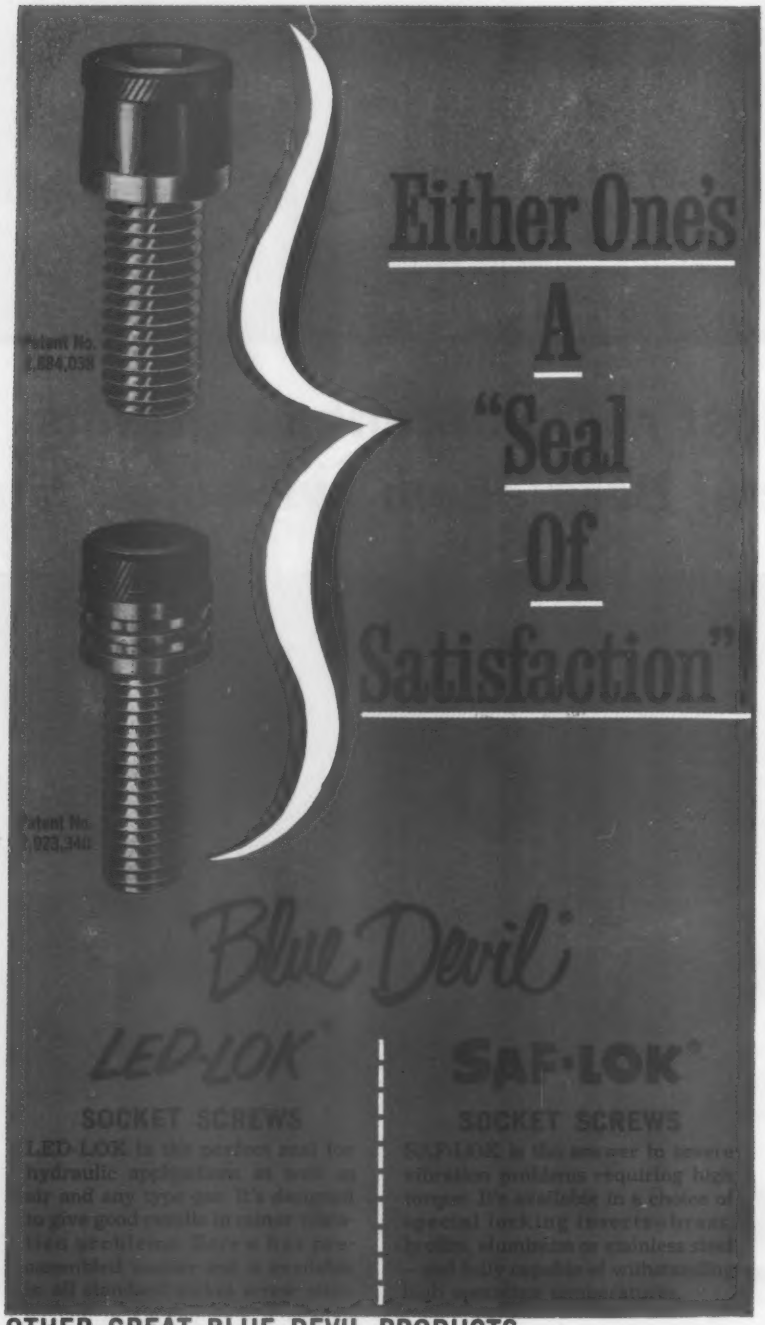

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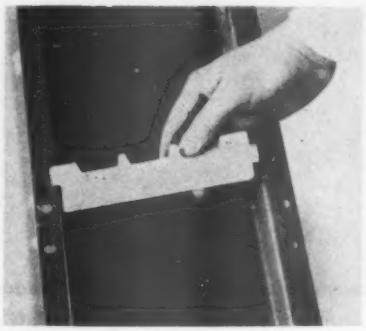


One piece polyester glass laminate bus bar supports slip into stamped slots in enclosure. Although molding costs 29% more than steel brackets, total cost of assembly was reduced through speeded production.

The material used for the new spacers is Phenolite GP 9206 polyester fiber glass laminated plastic made by National Vulcanized Fibre Co. Each spacer is a single piece of material. They are punched from polyester sheets.

Using the steel brackets, only about 50 sections of busway could be assembled in a working day. Polyester supports permit a regular schedule of 100 sections a day.

WELDING SYSTEM TAPE SELECTS WELD CONDITIONS

Up to ten weld conditions may be tape program sequenced or manually sequenced to correspond to any specific welding instructions required by a module or instrument. Each condition consists of a predetermined force and energy value.

Each system is a completely integrated, mobile work-station designed to give maximum weld speed and product reliability.

The automatic welding system, made by Weldmatic Division, of Unitek Corporation, can be used for electronic welding of microminiature component modules, fine wire, and complex vacuum tube assemblies.

The operator inserts the parts and actuates the head only. All force and heat settings are automatically set by the welding system.

The welding energy for each condition is adjustable up to 80 watt-seconds; electrode force is adjustable from 4 ounces to 15 pounds.

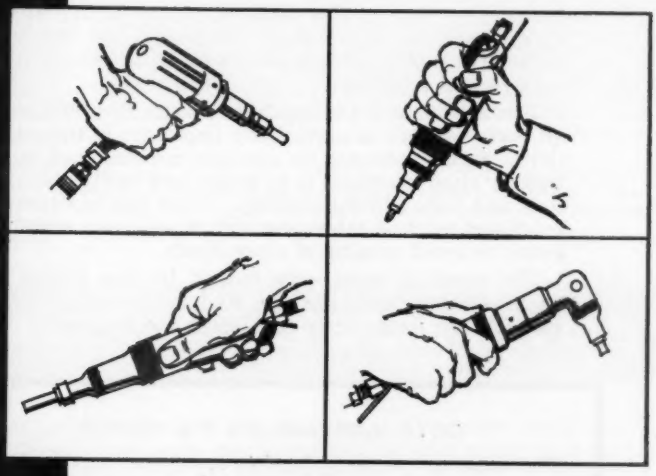
Each weld condition is pre-determined by developing a weld

continued

for screwdriving . . .

make these hands more productive with the right air tools

From watches to automobiles—for screwdriving, or any production fastening job, Gardner-Denver has the right air tool to keep expensive hands working at top efficiency. Attachments to drive all types, all sizes of fasteners provide hundreds of uses for the basic air motor. Assures complete versatility and interchangeability so vital to ever-changing production methods. For details, see your Gardner-Denver air tool specialist or write for Section 12 bulletin.



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Snap-on
MIDGET TOOLS
speed assembly of tiny components

159-TM-B Complete Midget Utility Set
¼-in. square drive — 59 tools in strong metal box

This SNAP-ON ¼-in. square drive set gives you a practical assortment of tools for small, intricate product assembly or maintenance work — electronic components, appliances, communication equipment, etc.

The 59-tool set includes deep hexagon and standard hexagon sockets ranging from ⅛ in. to ½ in.; square sockets; regular tip, Phillips, clutch-type and hex head screwdrivers; plus ratchets and a wide assortment of other handles and adaptors.

The fine quality and precision machining common to all SNAP-ON tools is particularly important in these tiny units. Socket openings, for example, are machined to extremely close tolerances to fit snugly and surely over tiny nuts and bolts without slipping. Driver bits likewise are machined to close tolerances and fit well into screw recesses to avoid gouging of screw heads.

The result is faster work output, far less rejects because of bolt or screw damage. And, because tough SNAP-ON tools last longer, they cost less in the long run.

SETS ASSEMBLED TO ORDER

The above set can be modified to meet your exact needs, or sets of specially selected Midget socket wrenches and other small tools can be developed to fit your exact requirements. Available, too, are Midget industrial sockets in black finish for use on power nut runners. Your SNAP-ON representative will be happy to give you full details. He offers a complete range of hand and bench tools for all industrial needs. Call your nearest branch or write us for new industrial catalog.

FOR ALL INDUSTRY
SNAP-ON TOOLS
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schedule. The resultant heat and force settings are then set on the control panel. Tape is then punched for the desired sequence and repeatability of each weld condition.

STAINLESS STEEL SPRING WIRE HAS HIGH STRENGTH

A stainless steel spring having tensile strengths up to 100,000 psi higher than music spring wire permits the use of smaller springs for a given capability or more capability in a given spring size.

The NS-355 spring wire, made by National Standard Co., has potential applications in jet engines, food and beverage equipment and chemical machinery.

The wire is suitable for compression and extension springs. Hooking can be done without difficulty.

After coiling, typical springs are stress relieved one hour at 700° to 800° F. Because of the wire's high elastic limit, the stress relief temperature may be lowered or stress relief may be eliminated.

WORK POSITIONER SPEEDS ELECTRONIC ASSEMBLY

To help speed precision assembly of electronic components, the Submarine Cables Corp. of Great Britain, uses a Wilton PowRarm work positioner.

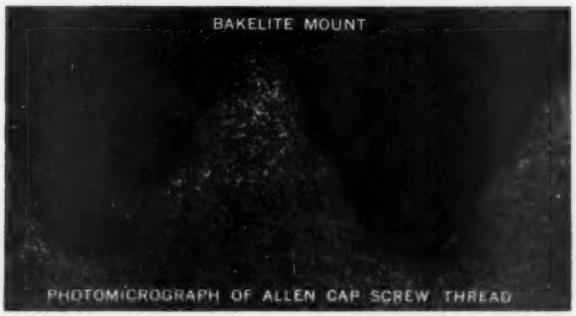
continued

PQA* proves it

This Allen screw passes multi-million-cycle test under high load conditions

50X Magnification—unretouched

Here you see a competitive socket-head cap screw where thread laps and deep decarburization (lighter area running through roots of threads) caused premature failure of the screw. When used under high load conditions in an outboard crankshaft-connecting rod-piston assembly, such a screw failure would cause great motor damage.



50X Magnification—unretouched

Now look at this Allen Socket Cap Screw. Photo was taken during regular quality control test and shows no thread lap or decarburization. Allen is producing to and inspecting in accordance with MIL-B-7838A for thread discontinuities—your assurance of quality!

*PRODUCT QUALITY ASSURANCE

PQA is the symbol of unquestioned quality at Allen. It stands for *constant* quality control from rigid upgrading of incoming raw materials to shipment of finished products—*plus* an unconditional guarantee that backs up every order!

Quality checks like the one illustrated confirm PQA every step of the way through Allen's manufacturing process. Remember . . . it costs no more to have *genuine* Allens right from stock, and they are only a minor fraction of your assembly costs.

Genuine ALLEN products are available only through your ALLEN Distributor. He maintains complete stocks close by to help cut your freight costs, inventory, warehousing and handling. He offers fast, single-source service. He knows ALLEN products. And he makes ALLEN Engineering Service available to you any time. Call him!

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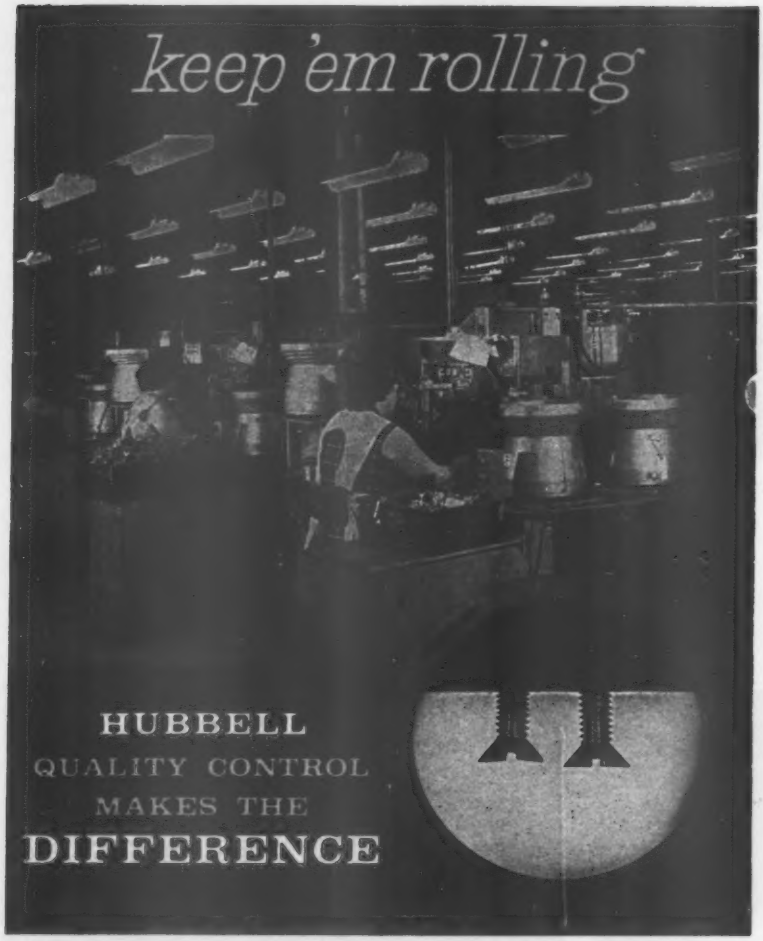

Without any warning, this smooth rolling production line could come to a screeching halt . . . all because of one imperfect fastener. You've had it happen all too often. Suddenly an automatic machine clogs and everything stops dead and stays stopped until the clogged machine can be fixed.

Hubbell precision fasteners are your best insurance against production snafus like this, because they are quality controlled at every step of manufacture to provide as uniformly perfect cold headed products as is humanly possible. It's our job to weed out the duds like the one at left in the viewmaster above, and supply uniformly perfect fasteners like the Hubbell one at right.

Contrast the two. Note how the Hubbell fastener at right is completely free of burrs or dirt that might jam an automatic machine. Also see how sharp and clean the threads are, and how deep and precise the slot. All these things add up to faster production, less down time, fewer rejects and a better end product.

Yes, if it's easier to fasten, it's easier and cheaper to assemble. Buy Hubbell precision fasteners and see.

IT PAYS TO HAVE HUBBELL GOOD CONNECTIONS

Quality FASTENERS

HARVEY HUBBELL, INCORPORATED
Machine Screw Department, Bridgeport 2, Connecticut

See the Hubbell Fastener Catalog in Sweet's Product Design File 7/Hu.

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The intricate and detail assembly work is performed on electronic components for repeaters used underwater along the route of the intercontinental submarine telephone cable. The job itself is speeded up because the operator can work the repeater chassis from any angle without resetting or moving the work piece itself.

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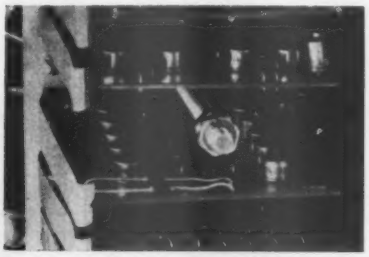

It was designed for their remote control digital supervisory system which involved a serious vibration condition. The printed circuit cards are held firmly in place with the clamp, maintaining proper electrical and mechanical connection.

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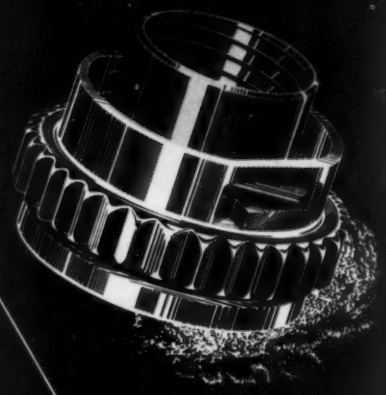

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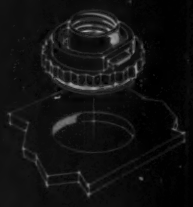

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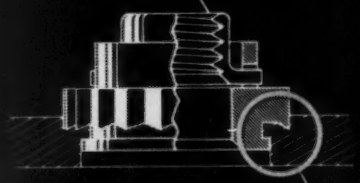

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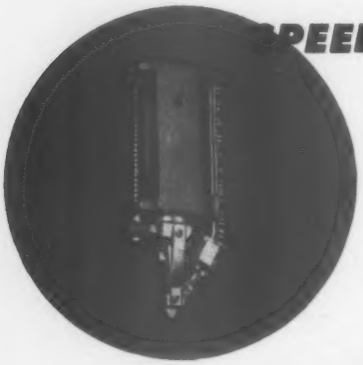

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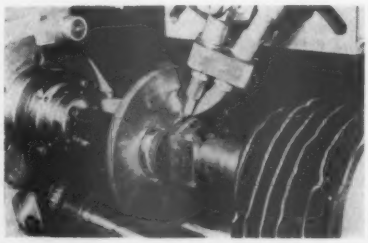

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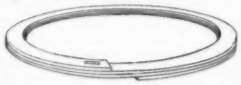

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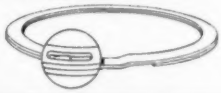

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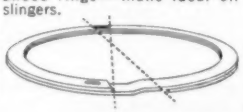

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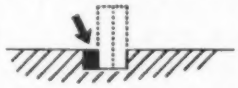

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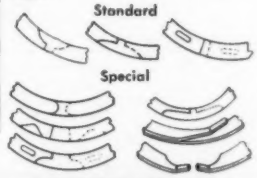

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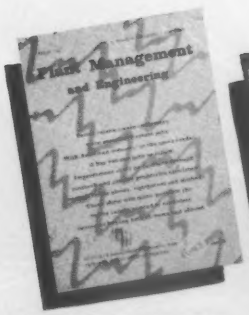

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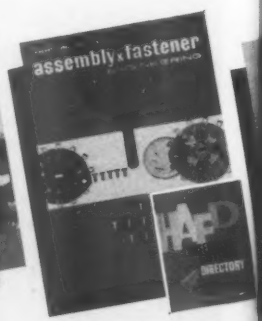

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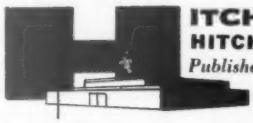

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Retaining tension in gasketed joints

Part 1

by **Earl M. Smoley,** Section Head
and **Frank J. Kessler,** Research Engineer
Physics Research Unit
Research and Development Center
Armstrong Cork Company
Lancaster, Pennsylvania

In this two-part article the authors will point out the directions a designer might take in attaining a minimum of tension losses in flat-faced gasketed joints.

Frequently, the bolts on a flat-faced gasketed joint design (Figure 1) are tightened to a preselected initial torque to produce the desired tension in the bolt, using a torque wrench which permits the tightening to be measured and controlled. After the joint assembly has been exposed to its operational environment for some time, the bolts are no longer under their initial tension, as indicated by a lower torque reading on the wrench. This difference is referred to in this article as torque loss. It implies a loss in gasket loading conditions. Excessive tension and/or torque losses are undesirable because there is always a possibility of their interacting with mechanical vibration. An interaction of this sort could lead to leakage.

Therefore, tension losses should be kept to a minimum, preferably zero, to insure the maintenance of the highest degree of tightness in a flanged joint. This cannot be achieved according to any rational set of flange design or gasket selection rules, until more basic knowledge is had on the tension loss problem. However, a body of empirical data has been accumulated over the past few years (1). The purpose of this article is to review this data with the idea of pointing out at least the directions a flange designer might take in attaining a minimum of tension losses.

Due to the difficulty of measuring tension in bolts, an assumption is made that there is a direct relationship between torque values and tension values. Therefore, in this article, high torques indicate high tension and vice versa. Also any reference to the loss of torque is assumed to mean that there is a corresponding loss of tension.

VARIABLES

How much torque is actually lost on a flat faced joint design will depend on a number of factors or variables. These factors can be logically categorized into three broad areas.

A. Flange design: (1) length of bolt; (2) initial flange loads on the gasket; (3) differential in thermal expansion between dissimilar metals in a joint assembly; (4) type of screw thread; (5) type of washer; and (6) cantilever projection on flange.

B. Environmental conditions: (1) time and (2) temperature.

C. Gasket: (1) composition and (2) thickness.

Those listed under flange design pertain primarily to the metallic components of a joint assembly. There are six of them. Under the environmental conditions or the conditions under which a flanged assembly is called upon to perform its function, there are two variables; time and temperature. Two more can be listed under the gasket itself; gasket composition and its uncompressed thickness. Hence there are a total of ten factors. On almost any flange design it is possible to adjust one or even more of these factors so as to keep the torque loss at a minimum; indeed, in some cases it might be possible to eliminate the loss entirely.

EXPERIMENTAL

Torque measurements in this study were obtained on the test flanges shown in Figure 1. The bottom flanges were machined from mild steel 1.0″ thick and threaded to receive four 5/16-24 NF hard steel bolts. Bolts were long enough to thread through the 1″ thick bottom flange when the test flanges were assembled and tightened. Top flanges varied in thickness from ½″ to 1½″. The flat washers shown were machined from drill rod steel.

The gasketing material used throughout the study was a beater saturated Buna N rubber asbestos material nominally 1/32″ in thickness unless stated otherwise. In the actual test for torque loss each test flange was torqued to a specified torque setting under room temperature conditions (73°F) then placed in an oven at 300°F for 18 hours. After this exposure the test joint was removed from the oven and

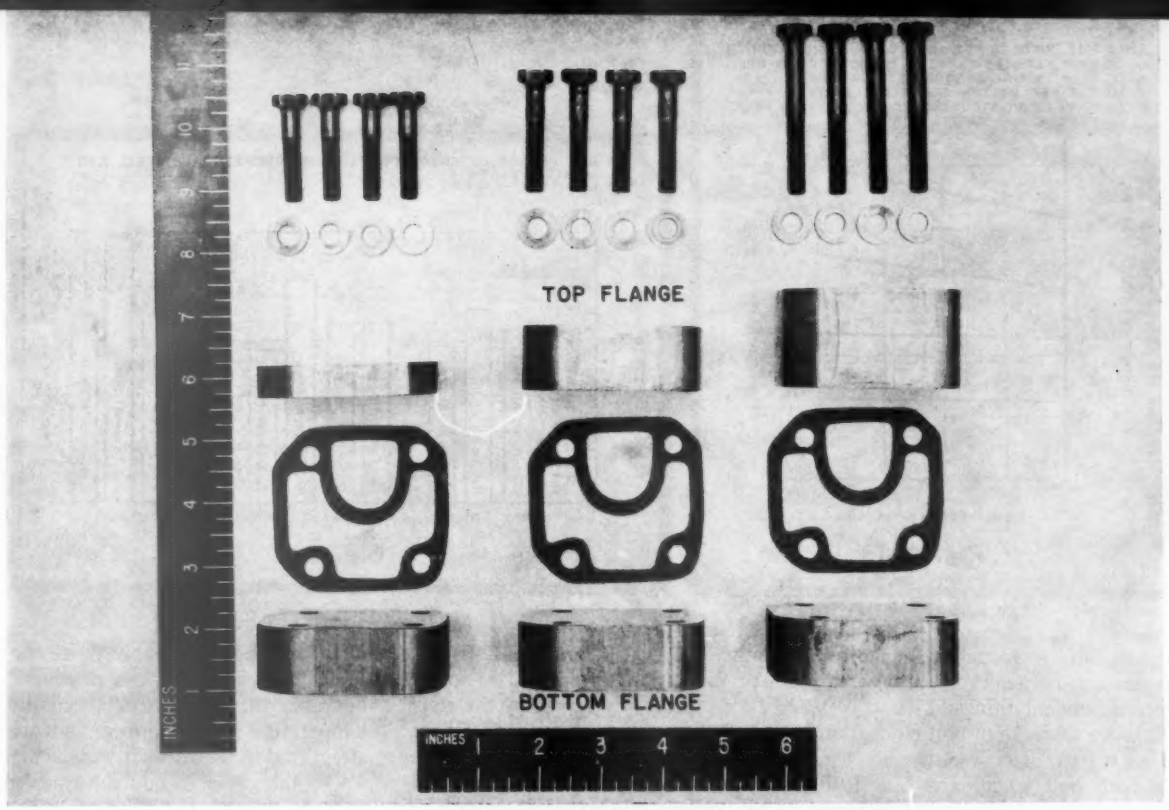

Fig. 1: Torque measurements in this study were obtained on these test flanges.

with as little cooling as possible the torque retained was evaluated with the aid of a hand torque wrench, turning it in the direction of tightening until the bolt just started to move relative to the flanges. This was recorded as hot torque. When the assembly cooled to room temperature (73°F) a final torque reading, referred to as cold torque, was also recorded. A light coating of SAE 20 motor oil was always used on the bolt threads.

BOLT LENGTH AND INITIAL GASKET LOAD

Bolt length is defined as the distance along the bolt axis measured from the underside of the bolt head to the sealing surface on the bottom flange. Such distance must be measured after a flange assembly is assembled and fully tightened. One might look at it as the sum of three things—the thickness of the flat washer, compressed thickness of the gasket, and the thickness of the top flange. Bolt length will vary according to joint design, but most generally it will be that portion of the length of the bolt which comes under axial strains when the bolt is loaded.

Initial gasket loads are the unit compressive stresses or flange pressures imposed on the gasket when the tightening operations on a joint assembly are completed. Initial gasket loads are proportional to the applied bolt torque. Techniques for the measurement of such loads over a wide range of conditions are fully covered in reference (2).

Bolt length combined with initial gasket loads affects torque losses in a manner shown by the plot of experimental data in Figure 2. Torque retained on the test flanges after exposing them to 300°F for 18 hours is plotted along the vertical scale and bolt length along the horizontal scale. At an initial torque level of 10 lb-ft the torque loss turns out to be 37%; that is, 37% of the initial 10 lb-ft of torque was lost. This holds for the range of bolt lengths from ½" to 1½". Note that the curve for the initial 10 lb-ft torque level is parallel to the bolt length axis which is another way of saying that bolt length has no effect. Increasing the initial torque level to 15 lb-ft reduced the loss from 37% to 23%. This is the result of an increase in compressive stress on the gasket. At 15 lb-ft of initial torque the bolt length still does not produce any effect on torque retained; however, above this initial torque level the bolt length effects become quite prominent. In fact, at 25 lb-ft of initial torque the long bolt (1½") absorbed or compensated for all of the torque loss that has taken place.

These results are not surprising. Long bolts undergo more total stretch or elongation than shorter ones providing the load or torque on each is the same. This elongation compensates for torque losses in much the same manner as a coiled spring would if it were substituted for the flat washer used between the bolt head and flange. However, the elastic properties of the bolt are of little consequence until the gasket has been properly loaded. It is an almost universal rule that an increase in gasket loads results in more torque retained, but the loading increase, to be most effective, should be mechanically coupled with as much elongation as can be tolerated. On the gasket it is a good idea to reach at least the critical or threshold compression loads specified in reference (3).

Consequently, from the above

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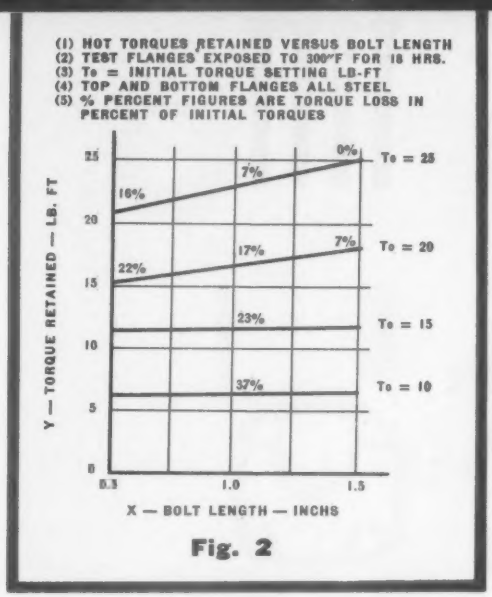


Fig. 2

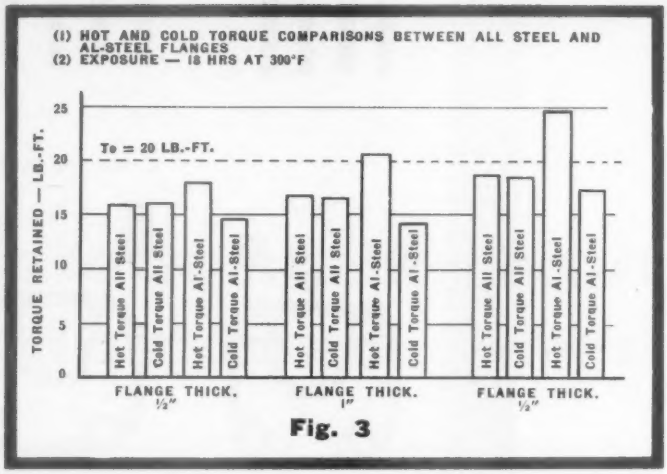

(1) HOT AND COLD TORQUE COMPARISONS BETWEEN ALL STEEL AND AL-STEEL FLANGES
(2) EXPOSURE — 18 HRS AT 300°F
TORQUE RETAINED — LB.-FT.
To = 20 LB.-FT.
Hot Torque All Steel
Cold Torque All Steel
Hot Torque Al.-Steel
Cold Torque Al.-Steel
FLANGE THICK. ½"
FLANGE THICK. 1"
FLANGE THICK. ½"

Fig. 3

discussion, a reduction in torque losses can be achieved through two interdependent things:

1. An increase in bolt elongation. This is had, of course, by increases in both bolt length and bolt load. The resulting load should produce the maximum possible elongation below the yield conditions for the bolt.

2. An increase in compressive stress on the gasket. Whatever the compressive stress might be, it should be at least equal to the minimum specified for the gasket material. For maximum effects these conditions along with those mentioned in (1) for the bolt should be considered together; one is not independent of the other.

THERMAL EXPANSION BETWEEN BOLT AND FLANGE

Differentials in thermal expansion existing in flanged joints because of dissimilar metals have a pronounced influence on torque losses. There are many such joint designs to be found in industry today, for instance in the automotive industry aluminum flanges are frequently clamped together by steel bolts. It looks as though designs of this type will increase in numbers in the immediate years ahead.

In the discussion which follows, comparisons will be made between flange designs with and without thermal expansion differences. An example of one without a differential is the test flange of Figure 1 when the steel flanges, both tops and bottoms, are bolted together by steel bolts. These will be called all-steel. An expansion differential is introduced merely by replacing the steel top flange with an aluminum flange —all other conditions remaining the same. This type of test joint will be called aluminum-steel. The reader might keep this distinction in mind.

The bar graph in Figure 3 permits a direct comparison between the torque retention properties of the all-steel and the aluminum-steel test joints. Differences between hot and cold torques are indicative of differences in thermal expansions between the bolt and flange or between these two components and the gasket. The hot and cold torques for all-steel flanges of Figure 3 are the same. There is torque loss, of course, but after the loss has occurred the temperature cycles appear not to affect the final torques retained.

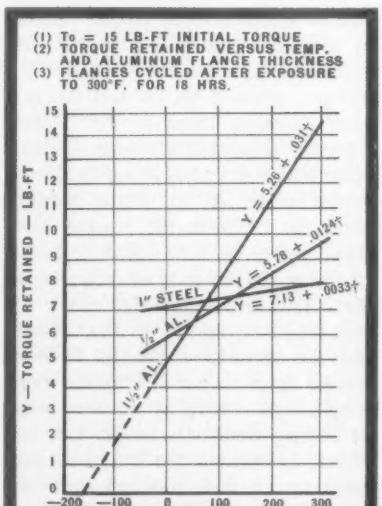

(1) To = 15 LB-FT INITIAL TORQUE
(2) TORQUE RETAINED VERSUS TEMP. AND ALUMINUM FLANGE THICKNESS
(3) FLANGES CYCLED AFTER EXPOSURE TO 300°F. FOR 18 HRS.
Y — TORQUE RETAINED — LB-FT
†—TEMP. °F
Y = 5.26 + .031†
Y = 3.76 + .0124†
Y = 7.13 + .0033†
1" STEEL
½" AL.
1½" AL.

Fig. 5

On the other hand, substituting the aluminum top flange for the steel flange changes the picture completely. As they should be, cold torques on the aluminum-steel flanges are about the same as cold torques on the all-steel assemblies. But the hot torques on the aluminum-steel are almost in direct proportion to the thickness of the aluminum flange. In fact, on the 1½" flange they actually exceed the initial torque setting of 20 lb-ft. This is a reflection of the differential in thermal expansion between the steel bolt and the aluminum flange; aluminum has an expansion coefficient roughly two times that of steel.

Another way of looking at the above torque comparisions between aluminum-steel and all-steel flanges is by the schematic diagram illustrated in Figure 4. The solid curve represents the torque retention properties of an all-steel joint design from the time when the initial torque is reached to sometime later when the torque retained is apparently stabilized and equilibrium values are attained. On this all-steel curve it is possible to superimpose the torque retention variations associated with an aluminum-steel assembly as it undergoes expansion and contraction due to heating and cooling.

Apparently, an aluminum-steel

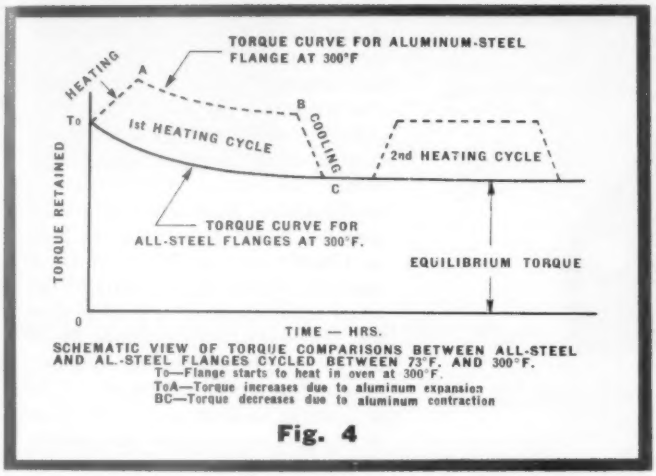


Fig. 4

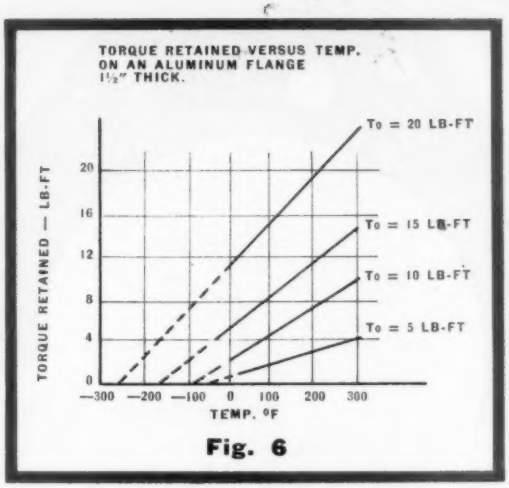


Fig. 6

flange design tightens when heated and loosens when cooled. These are the variations inherent in any such design. On the expansion part of the cycle the problem is not so much retaining enough torque as it is gasket extrusion which will be dealt with later. The cooling cycle, however, does give rise to difficulties. Here the contraction or shrinkage of the aluminum can lead to abnormally high torque losses. For instance, in Figure 5 the curve for the 1½" aluminum flange indicates a torque retained value of 14.6 lb-ft at 300°F out of a possible 15 lb-ft of initial torque.

Cooling the flange results in a linear loss in torque load; when —40°F is reached only 4 of the initial 15 lb-ft of torque remained on each bolt. This is an extremely wide variation. If the results are extrapolated to the temperature scale, as is indicated by the dotted line, apparently there is a possibility of the torque loads falling all the way to zero at —180°F. Temperatures this low are probably well below the normal operating range for most applications.

Figure 5 also contains a test curve on an aluminum flange only ½" thick, and the torque variations here are not nearly as wide as those for the 1½" flange. The torque retained on an aluminum-steel flange then is proportional to both the flange thickness and the temperature differential. This, of course, does not hold true for the all-steel flange indicated in Figure 5 because with a temperature swing from 300°F to —40°F the torque retained varied only 1 lb-ft, within the experimental limits of error of the torque wrench test.

A clue as to what can be done to offset the high torque losses due to aluminum contraction can be seen in Figure 6. Here the initial torque setting on the 1½" aluminum-steel flange has been varied from 5 lb-ft to 20 lb-ft, whereas the data in Figure 5 applied only to 15 lb-ft. Figure 6 indicates the importance of initial torque on the amount of torque retained. The higher the initial torque the higher is the torque retained. Moreover, higher initial torques tend to shift the extrapolated zero flange pressure intercept along the temperature scale toward lower temperatures. This, too, is highly desirable. Besides proper initial torques or flange pressures the one other thing which keeps the torque retained high is the gasket itself. It must be a good torque retainer. This is implied rather strongly by the data in Figure 6. So the adverse effects of the contraction in an aluminum-steel flange can be offset by two things: (1) increases in initial torques or flange pressures, and (2) gaskets with good torque bearing properties.

It has already been mentioned that the expansion of an aluminum flange is not a direct cause of torque loss but it is a factor in causing gasket extrusion which can be rather objectionable in some applications. Sometimes in the field extrusion is referred to as rupture, tear or plastic flow. An example can be seen in the gasket shown in Figure 7 where the gasket area particularly around the bolt holes appears to be expanded or enlarged. Another example is seen in Figure 8, only here the gasket seems to flow from between the flanges. Indeed, extrusion can be defined by the tendency of a gasket to flow laterally from between the flanges particularly when exposed to heat and high flange pressures. It is attributed to the inability of a gasket to translate the thermal expansion strains of the aluminum into bolt torque increases. Consequently, the aluminum flange brings into the gasketing problem more so than the all-steel flange the ability or capacity of a gasket to resist the extrusion effect.

Resistance to extrusion in a gas-

continued

Fig. 8: On this test part, gasket seems to flow from between flanges.

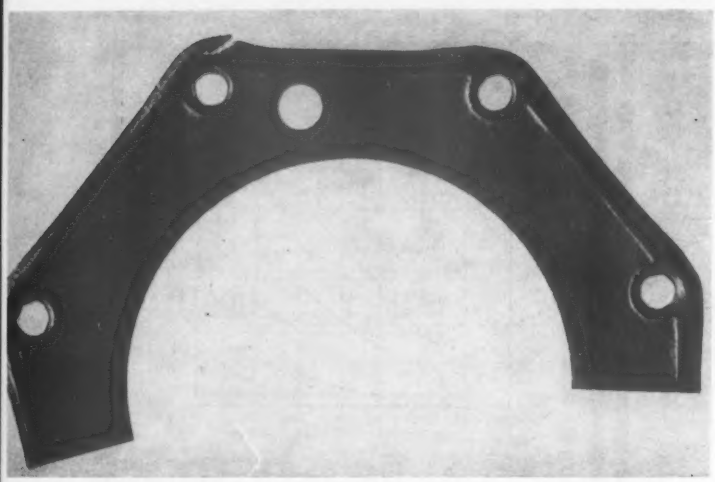
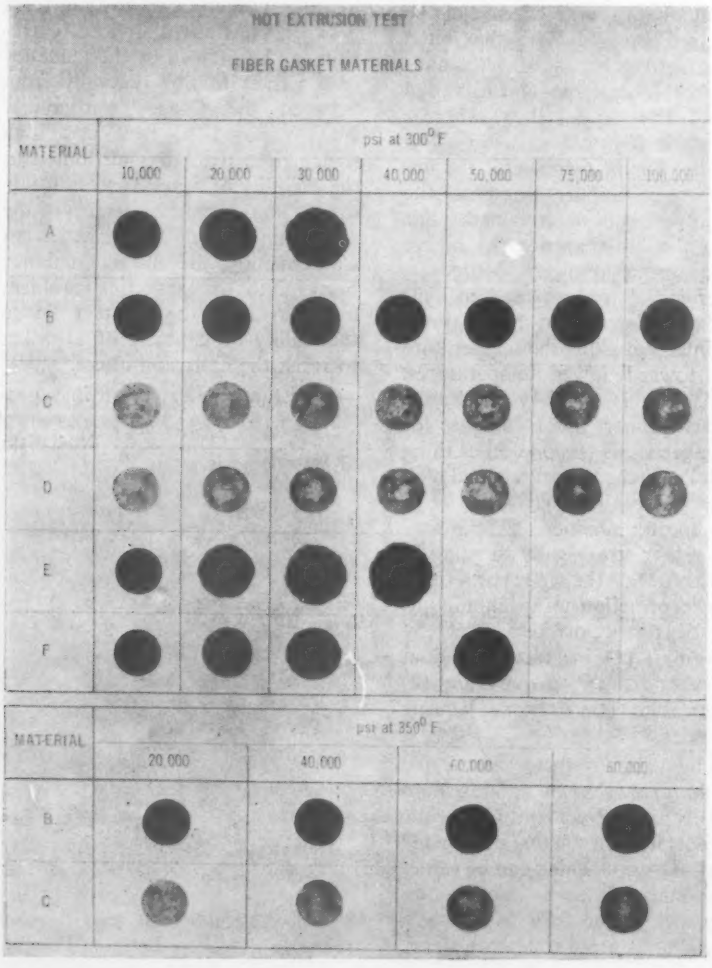


Fig. 7: Sometimes extrusion is referred to as rupture, tear or plastic flow. An example of this can be seen here where the gasket area around the bolt holes appears to be enlarged.

Fig. 9: Resistance to extrusion in a gasket varies with composition. For instance, resistance of those coded C and D (beater saturated rubber-asbestos compositions) is as high as 100,000 psi at 300°F, which is near the yield point of many metal components of a joint assembly.



ket varies chiefly with composition. This is seen from Figure 9. A series of test pieces for any of the gasket samples, which are coded by letters, were exposed to increasing compressive stresses at 300°F until a perceptible enlargement of the test occurred. Those coded C and D are beater saturated rubber-asbestos compositions. Resistance to extrusion for these materials is as high as 100,000 psi at 300°F which is near the yield point of many of the metal components of a joint assembly. The materials coded A, B, E and F are rubber-cellulose compositions. In general it is possible to list or arrange various gasket materials in an order according to their ability to resist extrusion.

1. Rubber-asbestos
2. Rubber-cellulose
3. Cork composition
4. Cork and rubber compositions
5. Rubber compositions

Number 1 would be the best, number 2 second best, and so on down the list.

In summarizing then, the aluminum-steel flanged assembly does not give rise to any new gasket requirements that might exceed the capabilities of present-day materials. Those currently on the market appear to be satisfactory, however, it does tend to restrict the choice of materials when flange pressures and temperatures are moderately high. The requirements might be considered from two points of view. When the aluminum flange expands against a steel bolt, resistance to extrusion is needed in a gasket. When contraction occurs upon cooling the torque loss is reduced by (1) flange pressures as high as practical and (2) gaskets with good torque retaining properties.

Next month in the conclusion of this study on retaining tension in gasketed joints, we will cover the effects of screw thread and washer types, cantilever projection, plus the effects of time, temperature and gasket thickness. •

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Uncased section of gyro instrument showing critical pin wheel in position. Only finest workmanship and materials can assure fail-free operation.

by **E. H. Heinemann**
Executive Vice President
Guidance Technology, Inc.
Santa Monica, California

How to tackle that elusive target of . . . . .

cutting assembly costs while improving quality

. . . . . by a top engineer in the aerospace field

Cutting costs while maintaining quality is a difficult objective. But cutting costs while improving quality is a much more elusive target. Yet today in America—in the interest of national defense, economy and progress—manufacturers of products for the Armed Forces, for scientific progress, and for maintaining our status as a major world power, must begin aiming at this later goal. Money spent for improvement in one direction detracts from money available for improvement in other directions. Too much money spent in one direction may be like removing the supports from under the far end of a bridge to brace the bridge under the approach.

In the manufacture of guidance instruments and control devices for air, land, sea and space vehicles at Guidance Technology, Inc. (formerly Summers Gyroscope Company) considerable study has been given to the problem of improving quality and reducing costs. Several possible approaches have been uncovered. Basically, these include simplified quality or value engineering, miniaturization, and production and assembly techniques specifically tailored to meet design requirements. Attacking the product cost problem at any of these points does not compromise quality, and in most cases results in improved quality.

Until recently, the production of instrumentation for terrestrial missiles, rockets and aircraft, for space vehicles, and for related ground and hydrofoil equipment, progressed under unfavorable circumstances insofar as costs were concerned. World tension and armament competition has kept the demand for these instruments, in ever improving versions, on a timely and consistent basis.

The instrument must be made available when needed. It must be of "no fail" quality, and accurate to extremes not considered a few short years ago. It must perform under little known and often unresearched environmental conditions. It must continue to perform and provide accurate data, either for visual or electronic assimilation, under conditions

continued

Edward H. Heinemann is an internationally distinguished aerospace leader. Prior to his affiliation with Guidance Technology, Inc., he served for several years as vice president, Combat Aircraft Systems, Douglas Aircraft Company, and for two decades prior to that as chief engineer for the Douglas El Segundo Division. During this period, Mr. Heinemann supervised the design of record-breaking jet and rocket airplanes. Many of the jet attack airplanes aboard Navy aircraft carriers today are his designs.

He has received numerous honors from the United States and abroad. In 1952, he received the Colliers Trophy, the highest United States aeronautical award. In 1953, he received the Sylvanus Albert Reed Award from the Institute of Aerospace Sciences. In 1955, he received the Federation Aeronautique Internationale Paul Tissandier Diploma. He has received many lesser but equally satisfying awards during his career.

Mr. Heinemann is a Fellow of the Institute of the Aerospace Sciences, The Royal Aeronautical Society of Great Britain, and the American Astronautical Society. He has acted as a consultant to many Government Agencies, and is a member of many advisory committees for the Department of Defense.

of shock, vibration, acceleration, deceleration, gravity, speed, centrifugal force, etc., never before encountered outside a research laboratory. These have been and continue to be unrelenting instrumentation requirements. They must be met with full cognizance of the fact that instrument failure at a crucial moment may cost a multi-million dollar project and many lives.

In the face of such stringent instrument requirements, the cost-cutting problem had to be approached cautiously. Quality standards already established could not be tampered with. Materials or purchased parts of lesser quality could not be considered. Plant equipment, techniques, and workmanship had to maintain the standards already set.

Our first approach to the problem was through simplified quality engineering and miniaturization. Instruments already being produced were studied for possible design changes that would simplify their production and assembly without affecting their operation. Joints, fastening techniques, geometric shapes, sealing possibilities, etc., were each given intensive scrutiny. At the same time, the possibilities of miniaturization were considered—the possibilities of making the instruments smaller, more compact, lighter in weight, and often the possibility of combining several instrument elements, formerly in separate cases, into a single case.

A single example will illustrate how miniaturization, properly used, can result in improved quality at lower cost. This example is Guidance Technology's new gyroscopic attitude indicator called "Vigil." Formerly, vertical gyro indicating systems consisted of an indicator, a remote gyro, a rate switch, and the cables required to connect these elements together. Being self-contained, the Vigil provides the same results with one unit at only a fraction of the cost, weight and space previously required. It requires less raw material, fewer purchased parts, and is much easier to assemble than the three separate system elements mentioned above.

Before describing our assembly techniques at Guidance Technology, we would like to cover a lot of ground in a somewhat broad statement . . . Design engineers at Guidance Technology are fully aware at all times that their work is only the first in a long line of contributions to any new product. The design must be produced, then the product assembled before it can become a reality. Every effort is made during design to simplify these subsequent operations. Only the closest cooperation between design, production, and assembly can result in ultimate quality at reasonable costs. While instrument assembly is necessarily a complex operation, it will be noted from time to time in the following paragraphs how thoughtful design considerations have kept the complexities at a minimum.

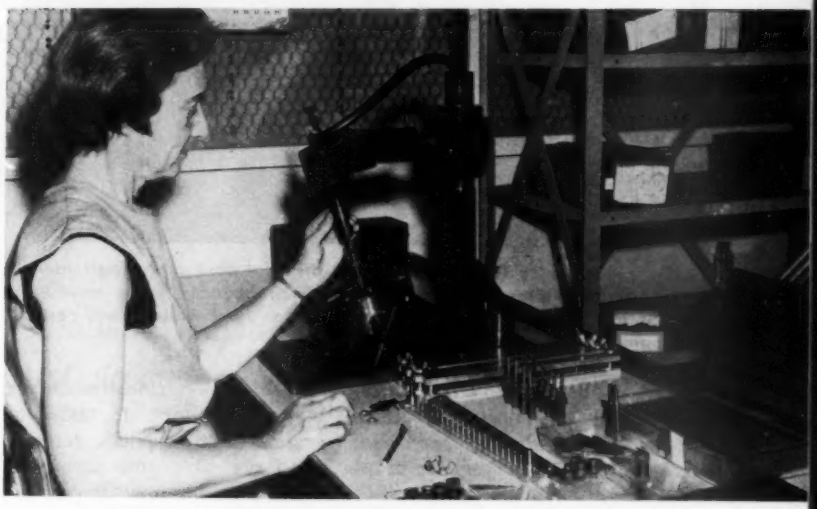
Except for standard hardware (nuts, bolts, screws, etc.), very few purchased parts are used in instrument assembly. This is because such parts are not commercially available, or are not available in the quality required. The few parts or subassemblies that are purchased must pass rigid receiving inspection, and in many cases require rework or specific adjustments before they are incorporated in the instrument. This means that most assembly operations "start from scratch," so to speak, in jobs such as laminating and winding the field coils and armatures for small gyro motors, the make-up of miniature printed circuit boards, the assembly of miniature amplifiers, etc., etc.

Assembly at Guidance Technology is accomplished in job lots. Standard or shelf-type instruments are assembled in rather uniform lots, dependent, of course, upon current market requirements. More specialized instruments are assembled as required, and in lots conforming to specific requirements. Parts for assembly are withdrawn from a centralized stockroom where production parts and purchased parts are brought together, rigidly inspected, then stored against future use.

Cleanliness is vitally important in all phases of instrument assembly. While some subassembly operations can be carried on under normally clean shop conditions, final assembly must be accomplished in controlled cleanrooms. A speck of dust, or a dimensional change caused by a few degrees change in room temperature, will often exceed the assembly tolerances that must be maintained. Four controlled cleanrooms are provided in our assembly department, each capable of maintaining air cleanliness down to 50 particles a micron or less in size per cubic foot of air, a temperature of 72° F., ± 1° F., and a relative humidity of from 35 to 40%. In addition—and for very critical jobs—transparently shielded work benches are provided in the clean-

Soldering instrument case sections together to provide a hermetically tight seal. Metal strip is sweat-soldered across butted joint of case sections. This simplifies subsequent case dis-assembly when necessary.

In reconditioning cleanroom at Guidance Technology, new bearings are being checked for noise-dwell level at right, and are being machine-cleaned for re-lubrication at left.



Compressing stator laminates onto a mandrel tool prior to cementing them together. Stator will be used in the assembly of small gyro motor.

Winding the stator of a small gyro motor is accomplished with this automatic coil winding machine. Some of the other stators must be wound by hand.

room area. An inert gas (usually dry nitrogen) is admitted under this shield to exclude normal cleanroom air while the work progresses.

Cleanroom employees wear uniforms, caps, and special shoes. All parts entering or leaving a cleanroom area do so through air locks which minimize the mingling of exterior and interior air. A large centralized vacuum system powers a vacuum outlet at each work bench so that accumulated assembly dirt is sucked away rather than blown into the surrounding air.

A detailed step-by-step description of instrument assembly is far beyond the scope of this article. Some of the operations are very specialized; others employ techniques which would be applicable in assembling other products. For the benefit of Assembly & Fastener Engineering readers, we will concentrate on the latter.

A lot of products employ ball bearings. In a gyro mechanism, the bearings in which a gyro spin wheel rides are a very critical item. While these are purchased parts, no bearing is installed in an assembly until it has been carefully checked, tested, and reworked if necessary.

Incoming bearings are first checked for their noise-dwell level. This is accomplished on a sensitive audio test instrument which indicates the noise a bearing makes while being rotated at a certain speed.

Several techniques are employed to make certain that a bearing is properly lubricated. Some are lubricated with a hypodermic needle, using an oil drop of a specified diameter. Grease-packed bearings are usually lubricated with a specified weight of grease. Some bearings are lubricated in excess of requirements, then are whirled so that centrifugal force generated at a specific speed "throws off" all but the required amount of oil. After the bearings are reassembled and lubricated, they are again checked for noise-dwell level before being accepted for assembly. This bearing rework is accomplished in a small, specialized cleanroom.

The assembly of very small and specialized high-speed gyro motors occupies one entire section in our assembly department. While most of this work is rather routine, the technique used to laminate certain field coil pieces could be employed by anyone faced with assembling small motors.

continued

Here a piece of ice is pressed against the dial case of an instrument which has been oven-heated at 165°F for two hours. If any moisture remains in the instrument case, the dissimilar temperatures will result in fogging of the dial glass.

For optimum magnetic properties, these laminates must be grain-orientated one with the other. Also, to avoid affecting the magnetic properties, they must be handled with care as a mechanical shock is injurious. These laminates are first stacked together by hand on a small jig which provides proper orientation. They are then removed from the jig and slipped over a male-type mandrel tool which again retains proper orientation. Using another hand-operated tool, a compression spring is pressed down upon the laminates and locked in place on the mandrel tool. This assures proper compression of the laminates while they are cemented together.

The compressed laminates, along with the mandrel tool, are then emersed in liquid cement for 15 minutes to allow time for penetration of the cement between the laminates. They are then removed from the cement, and the surface is wiped with acetone. The laminated structure, still under compression, is then baked for 1 hour at 100°F., followed by another hour's bake at 400°F. The laminated and cemented field coil pieces are then ready for winding.

As might be expected, the gyro spin wheels must be critically balanced during assembly. Any unbalance in this relatively heavy, rapidly rotating wheel would set up vibrations which would drastically affect instrument accuracy and service life. Specified balance requirements average around 20 micro-ounce-inches, and range down to 5 micro-ounce-inches on the more critical wheels.

As airborne instruments of all types must operate under a wide range of atmospheric temperatures and pressures, and are often subjected to extreme temperature and pressure changes within a very short time, such instruments are usually assembled in hermetically sealed cases which in turn are filled with an inert gas at controlled pressure. Internal gas pressure is usually midway between the extremes to which the instrument will be subjected.

One of the biggest problems involved in assembling this type of instrument is complete removal of all traces of moisture from within the instrument case prior to final sealing and purging. If any moisture remains, it will cause fogging of the instrument dial glass during quick changes from warmer to colder altitudes. Bad cases of fogging render the instrument useless to the pilot and has been responsible for some airplane accidents.

Final purging of the sealed instrument case will not remove all the moisture from certain porous materials such as micarta, wire insulations, etc. Thus instrument components made of such materials must be oven-dried at the highest permissible temperature prior to final assembly in a humidity controlled cleanroom. After oven drying, these components are sealed in plastic bags until used in final assembly. After these instruments (in which contained moisture might cause dial glass fogging to occur) are completely assembled, purged, and filled with an inert gas, they are heated for two hours in an oven at 165°F. They are then removed from the oven and a piece of ice is immediately held against the dial glass. No fogging must occur even at these temperature extremes (165°F. inside the instrument case, a dial glass temperature of 32°F.).

Of course, the instrument components must be assembled into the instrument case sections before final assembly of the hermetically sealed instrument case takes place. A straight butt joint is used in case assembly. The butt joint is overlapped by a metal strip which is sweat-soldered in place. This not only simplifies initial case assembly, but makes it far easier to disassemble the case for subsequent instrument repair. A fused joint between the case sections would make disassembly extremely difficult.

After case assembly, the instrument is filled with helium gas then checked for leaks using a mass spectrometer. Maximum permissible leak rate is 0.1 micron per cu. ft. per hour. If the instrument passes this leak test, it goes into the purging chamber where it is continually purged with dry nitrogen gas at 165°F. After purging—and without removing it from the purge chamber —final filling with the correct inert gas at the proper pressure is accomplished. The instrument is then ready for the final quality control test and check-out program, for calibration, for a check of internal lumination against laboratory standards, and for the many other operations which assure that it will meet all rigid requirements.

While only the high points in critical airborne instrument design, production and assembly have been touched upon in this article, these high points emphasize the importance of close cooperation between the three. Without such cooperation, a cost-cutting design innovation may result in elevated production and assembly costs which more than nullify the gain. When quality cannot be compromised, the only pathway to lower costs is through simplification . . . simplification in design, in production, and in assembly, accomplished in a manner so that it benefits all three.

And at Guidance Technology, we have been pleasantly surprised to discover that simplification usually results in far better quality! •

by **Frank J. Dietrich,** Project Engineer
Twin Coach Company, Buffalo, New York

SPOTWELDING CONTROL FOR RELIABILITY

Elements of successful spotwelding certification program at Twin Coach Company include machine qualification, job certification, and production process control.

A program established to achieve a high level of quality, and a sustained effort to maintain the elements of this program intact, is the key to reliable spotwelding at Twin Coach. The elements of this successful program include Machine Qualification, Job Certification, and Production Process Control. Why the program is successful becomes obvious with a review of some of its details.

In order to develop manufacturing capability to consistently produce spotwelds of high quality and reliability, equipment is needed which has this inherent capability. In order to ascertain whether or not equipment on hand or procured has this capability, Machine Qualification is required. Twin Coach has a procedure established for determining this machine capability which has been used to "qualify" every spotwelding machine used in production of spotwelded structures.

At weekly intervals at Twin Coach, a spotwelded part is chosen at random for rip testing. Components of the assembly are ripped apart and the nuggets of the weld are examined for consistent pullout and uniformity.

To qualify a machine, the machine manufacturer's recommended settings for maximum and minimum combinations of metal thicknesses are used for starting points. Spotwelding schedules for these high and low spotwelding limits are tentatively confirmed or developed with numerous preliminary trial welds. Tentative schedules include coordinating machine settings for weld pressure, current time, and current decay. When the spotwelding specialists are satisfied that optimum settings are tentatively established with this preliminary work, qualification test work begins.

MACHINE QUALIFICATION

The first reliability factor checked during qualification is the ability of the spotwelding machine to consistently produce acceptable spotwelds. One hundred consecutive welds are made, using the tentative welding schedules, in each of two sets of overlapped test panels representing the high and low joint thickness limits of the machine.

These panels undergo x-ray examination whereby each individual spotweld is examined for presence of defects. If defects are noted, adjustments are made in the machine settings to refine the weld schedule for the thickness combination exhibiting defects. The weld consistency test then is repeated. When x-ray analysis indicates that all welds are free of defects, the welded panels are cut into individual spotweld

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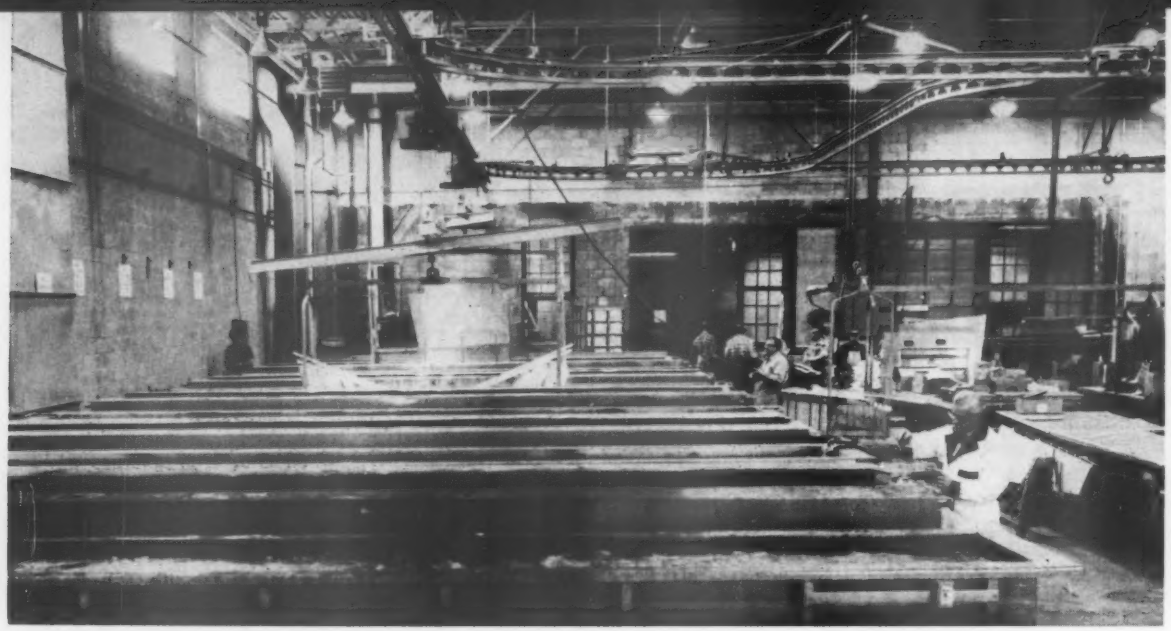

Solutions used in cleaning the metal prior to spotwelding are checked daily, and a log kept of composition and corrections. In addition, daily checks of the surface resistance of parts after cleaning are made by Electronics Laboratory personnel.

Since the shear, macro and bend tests are performed on a continuous schedule, test equipment is set up within the Spotwelding Department. This equipment is operated and maintained by Quality Control personnel.

specimens, one hundred for each thickness combination.

Five spotweld specimens are taken at random from each set of 100 specimens. These specimens are cross sectioned for macrographic examination. Again, if any of the cross sections reveal defects in the spotwelds, machine settings are adjusted appropriately and a new set of weld panels are made which are subjected to x-ray and macrographic analysis.

The remaining 95 welds from each set of 100 test specimens are tested for shear strength. Average, high, and low shear values for the series of specimens are noted. If all values, even lowest values, are not above acceptable minimum values for the gages of materials used for qualification, the entire qualification procedure is repeated with new machine settings appropriately adjusted to eliminate the condition causing reject.

The qualification procedure used at Twin Coach requires 100% acceptance of all spotwelds prepared through each phase of spotweld examination. This requirement is more stringent than Military and Customer specification requirements which allow a small percentage of subquality welds within specified limits.

Upon successful completion of the machine qualification test program, records of test data certifying machine qualification are signed by authorized personnel of the Government Agency maintaining facility surveillance (Navy), the Customer, and representatives of Twin Coach Plant Engineering, Quality Control, and Materials Laboratory. Copies of the Machine Qualification Records are filed with the Agency, Customer, and within Twin Coach.

Machine Qualification as described was accomplished on each machine in operation at the time this program was instituted more than twelve years ago, and is required of each new machine acquired, each machine moved from one location to another, and each time a machine receives major repair. In addition, each machine undergoes a 30-day

All parts of a structure to be spotwelded are assembled and checked for fit upon receipt. Acceptable parts are then submitted for cleaning.

check which assures top quality machine performance is being maintained.

JOB QUALIFICATION

Machine Qualification confirms that the machine is capable of consistently producing spotwelds of high quality within the designed range of the machine. Therefore, it is established that the basic element for spotweld production of structures with a high level of reliability is on hand, a qualified machine.

Attention now progresses to putting the machine to work. This requires Job Certification, which means establishing weld schedules for every thickness and alloy combination existing in the joints of the structure to be produced. Weld schedules include settings for weld pressure, current, time, and current decay.

Schedules are tentatively established with preliminary trial welds of each joint combination. When it is considered that the optimum combination of settings is established, Job Certification begins.

Twenty-eight welds are made in a lap joint panel of each joint combination. These welds are given x-ray examination. If defects are found, adjustments are made in the machine settings for each of the joint combinations found defective. Test panels are made again and given x-ray examination. When all welds are found satisfactory, the panels are cut into individual spotweld specimens.

Three of the specimens from each group of 28 are selected at random for bend test. These are sectioned through the spotweld and each sectioned specimen is placed in a vise and bent 45° with the radius of the bend in the weld. The three welds are examined macrographically for cracks. If any are found defective, machine settings again are corrected for the joint combinations involved and the preceding Job Certification steps are repeated.

Five specimens then are picked at random from the remaining 25 in each group for macrographic examination. These specimens are sectioned and examined for penetration, inclusions, nugget size and configuration.

If all of the macrographic specimens are acceptable, the remaining 20 specimens in each group are tested for shear strength. The high, low, and average shear values are established for each group of specimens. In accordance with Twin Coach policy, the low values must exceed Customer specification requirements without exception and

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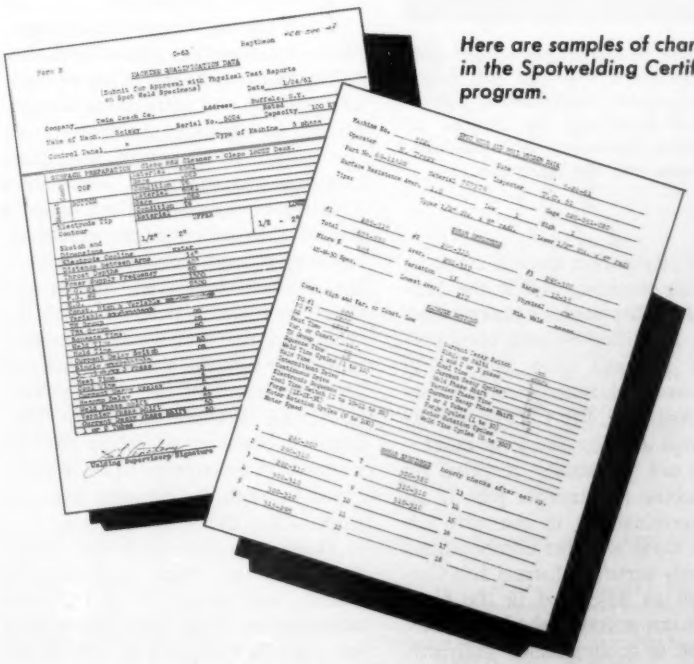
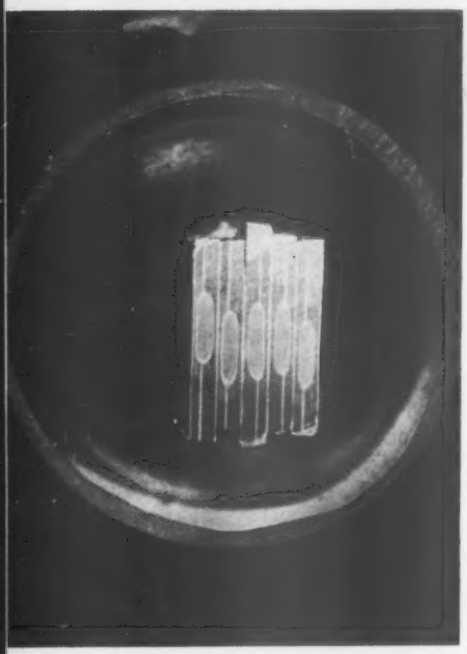


Here are samples of charts used in the Spotwelding Certification program.

without advantage of the latitude offered in most Customer specifications.

As in the case of Machine Qualification, Twin Coach requires 100% acceptance of spotwelds during each step of Job Certification. If this acceptance is not achieved, appropriate adjustments in machine settings are made and certification is repeated regardless of the progress made before rejection occurred.



Shown are five cross-sectioned spotweld specimens mounted for macro or micrographic examination. Specimens are examined for degree of penetration, presence of inclusions, nugget size and configuration.

Job Certification records are kept with each machine, and in the Materials and Electronics Laboratories, and are identified by joint combination of material gage and alloy. When new work is assigned to a particular machine, Job Certification is performed only for the joint combinations not previously certified on the machine for another job. If all joint combinations in the new job are the same as joint combinations previously certified, formal Job Certification as described in the foregoing is not accomplished. Job Certification is accomplished indirectly through daily routine Quality Control procedures.

Records for Job Certification bear the signatures of Navy, Customer, and Twin Coach Plant Engineering, Quality Control, and Materials Laboratory personnel.

Job Certification occurs each time a new job is run if similar joint combinations have not previously been certified, when new type or configuration of electrodes are installed in a machine, and when a change in the structure design is made which affects material alloy or gage.

PRODUCTION CONTROL

With completion of Job Certification, production of a certified job can begin. This in no way implies that Quality Control can be relaxed. In fact, each assembly is under continuous Quality Control surveillance during spotweld assembly.

All components of a structure to be spotwelded are assembled and checked for fit upon receipt in the Spotwelding Department. Assemblies considered acceptable for spotwelding by check of the pre-fit assembly are submitted for cleaning.

Cleaning for spotwelding is accomplished by successive immersion in a vapor degreaser, alkaline cleaner, warm water rinse tank, deoxidizer, cold water rinse tank, and a drying tank. The procedure and solutions conform with Military Specifications for spotwelding.

Daily checks for solution composition are made by Materials Laboratory personnel, and a log of daily composition and corrections is maintained. In addition, daily checks of the surface resistance of parts after cleaning are made by Electronics Laboratory personnel. Here again, a log of the daily surface resistance readings is kept. Periodic changes of the alkaline cleaner and the de-oxidizer are made as determined by the frequency and magnitude of composition corrections and by the trend from optimum of the daily surface resistance measurements. The time interval between complete changes varies with the volume of work processed through the cleaning line, but approaches monthly intervals.

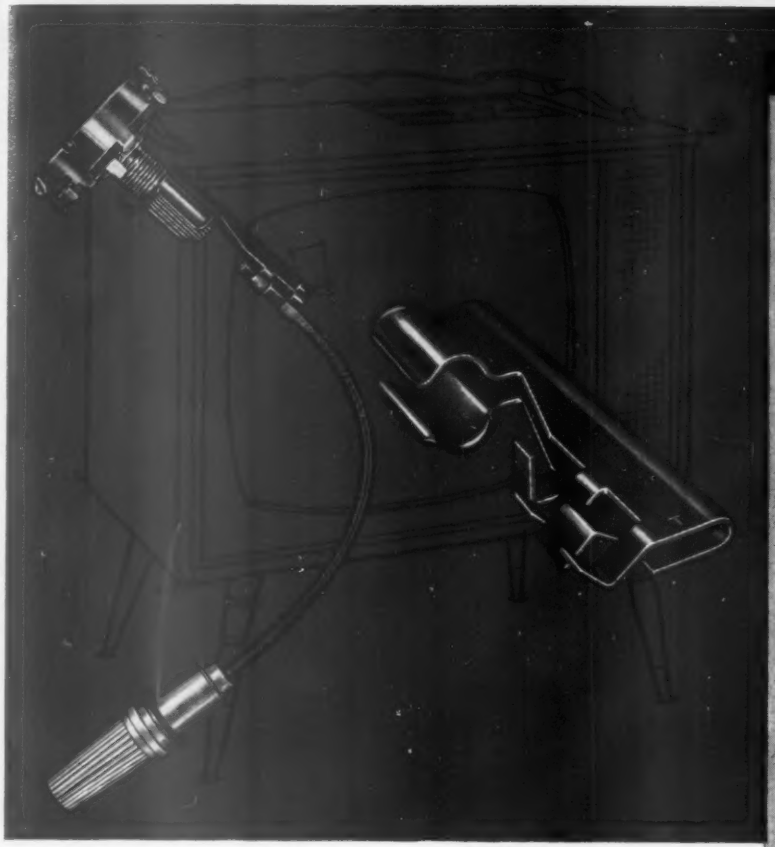
Daily production on each spotweld machine begins with a shear, macro, and bend test of the joint combination of the assembly in work on each machine. This test is repeated every hour that the assembly is in work, each time the joint combination in an assembly changes requiring new machine settings, at the end of an assembly run, and at the start of a new assembly run.

Electrode contour checks are made at frequent intervals by the machine operator, and when required to maintain spotweld quality, electrode tips are changed. This change in tips, or electrodes if changed for any reason, is always accompanied with a shear, macro, and bend test.

Since the shear, macro, and bend tests are performed on a continuous schedule almost without interruption, testing equipment is set up within the Spotwelding Department. Quality Control personnel operate and maintain this equipment, and submit the shear testing machine for calibration check at two month intervals. Quality Control also maintains a log of all tests made during production of all spotweld assemblies.

At weekly intervals, a spotwelded assembly is chosen for rip testing. This assembly is taken from a spotwelding machine at random as it is completed. Components of the assembly are torn, or "ripped," apart and the nuggets of the welds are examined for consistent pullout and uniformity. Each week a different assembly is chosen, from a different machine, and in this manner a continuous consistency check is performed on each machine used in production. A test report and photographic record is made and kept of these destruction tests.

At first glance it may appear that spotweld control as practiced at Twin Coach results in high cost of spotweld operations. The opposite is true. Problems do not develop. Therefore, all effort associated with spotwelding is productive, since productivity is not depressed with corrective effort required when problems develop. Quality Control records attest that Twin Coach spotweld operations are trouble free and result in a high grade of production with negligible rejection. Therefore, a high standard of quality, at low cost, for the customer is achieved. But, more important, this results in reliable spotwelding and assures the customer that the structure will live its expected life in service. •



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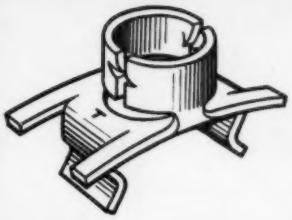
SPEED CLIP® gives Sylvania easier, more reliable, more flexible assembly

This new Tinnerman-engineered SPEED CLIP fastener provides a faster, more flexible connection between control "pots" and knobs on a TV manufactured by Sylvania Electric Products, Inc. The fastener can be applied wherever similar components are mounted and space limitations pose an assembly problem.

Several advantages are offered over methods previously used. Assembly is easier and faster . . . mating parts are simply pressed together and secured under live spring tension. Built-in ratcheting action permits overload slippage to protect the control from over-adjustment. Designed for use with a flexible cable, mounting of the control is completely independent of the knob location. They can be perpendicular to each other anywhere within 360°. Finally, this fastener is stamped with the Tinnerman T-mark, as are all SPEED NUT® brand fasteners. This is your assurance that Tinnerman quality and total reliability are going into your products wherever these fasteners are specified.

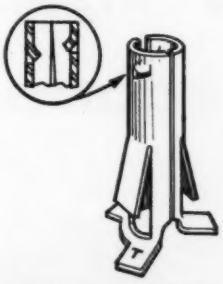
For samples, literature, prices, call your Tinnerman sales office . . . listed in the "Yellow Pages" under "Fasteners." Or write to: *Tinnerman Products, Inc., Department 12, P. O. Box 6688, Cleveland 1, Ohio.*

T-MARK ENGINEERED SPECIALS



TRANSISTOR CLIP saves weight and space, snaps quickly into panel . . . no screws, rivets. Designed for coil form retention, this SPEED CLIP fastener proved ideal for fastening transistors. Tubular retaining collar has excellent heat sink properties, openings at sides and bottom allow air circulation.

FRONT MOUNTING SPEED CLIP FASTENER cuts front panel assembly costs on popular washer-dryer. Unique self-retaining SPEED CLIP fastener permits simplified front mounting for easier, faster, lower cost assembly of front panel. No welding, staking, screw driving . . . ends scrap hazard. Four fasteners engage panel mounting flange as it slips in place over curved spring fingers. Assures firm vibration resistant assembly, yet easy removal for servicing.



BOWDEN CABLE CLIP is one of many Tinnerman designs to fasten armored cable. Designed for car instrument panels, it's the perfect answer to through-panel cable fastening problems. No welding, staking, clinching, no special mounting brackets or clamps. Live spring tension prohibits vibration . . . prevents loosening.

TINNERMAN
Speed Nuts®
Look for the Tinnerman "T"

CANADA: Dominion Fasteners Ltd., Hamilton, Ontario. GREAT BRITAIN: Simmonds Aerocessories Ltd., Treforest, Wales. FRANCE: Simmonds S.A., 3 rue Salomon de Rothschild, Suresnes (Seine). GERMANY: Mecano Simmonds GMBH, Heidelberg.

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Modular equipment and accessories permit a variety of assembly operations in a minimum area. Circuit board and plaque board assembling, wire jigging, pre-fabrication, and final assembly can be performed in close proximity.

HOW MODULAR EQUIPMENT ECONOMIZES ASSEMBLY SPACE

Peg-board isolation screen also provides for additional parts/tool storage.

A modular system of assembly benches, work stations and parts bins has enabled North American Aviation, Inc. to efficiently compress some of their electronic assembly operations in 35% less space.

Where work consists solely of standard circuit board assembly, space requirements have been reduced to approximately 50% of the

In typical installation, plaque board assemblers use 12" clip-on shelves and work positioning vises.

area formerly required when using conventional bench setups.

This modular equipment is installed in a Class D cleanroom (where dust is controlled down to 10 microns) at their Crenshaw Facility, in Hawthorne, Calif. This room houses North American's "inertial navigational support," "armament and flight control support," and "computer and data systems support" departments.

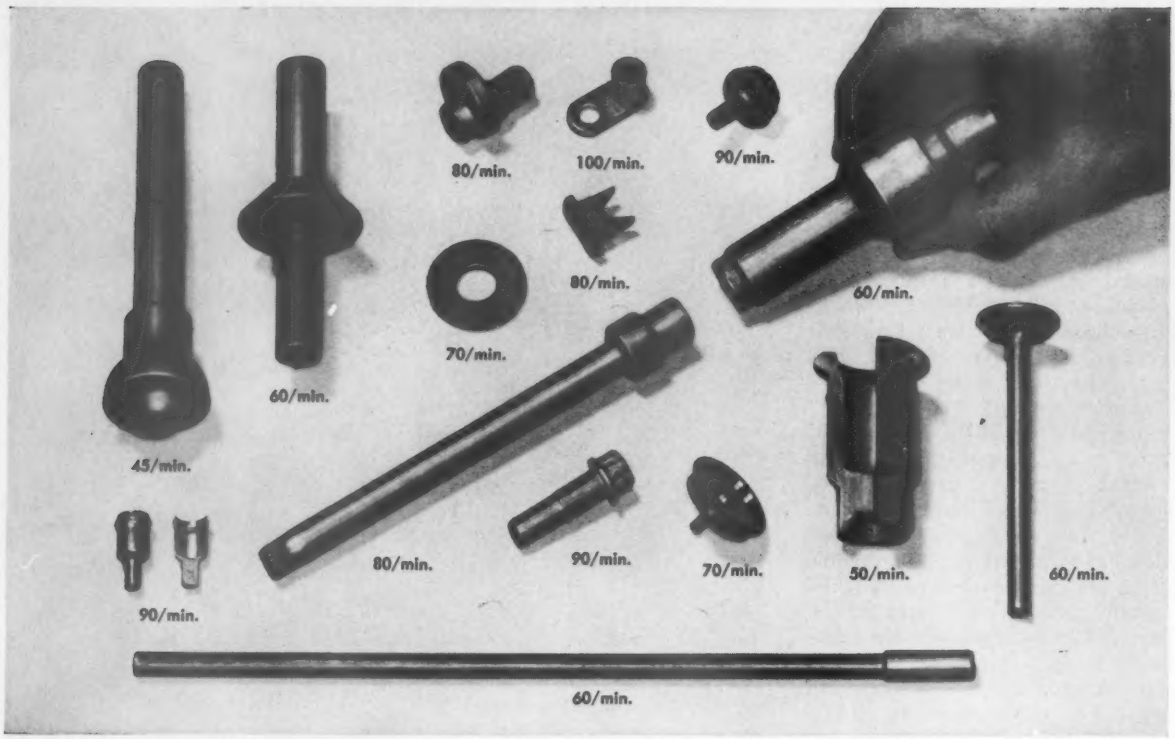
Working with Flotron engineers, North American was able to place 120 Flo-Line sections (240 assembly work stations) in an area of 6,188 square feet. Of that area, 2,638 square feet were allowed for extra-wide aisles, leaving 4,550 square feet devoted to work stations and adjacent seating/working areas. This allocates nearly 19 square feet for each individual station.

The extra-wide aisles gives North American a built-in plant versatility, enabling them to be in a position to immediately increase productive square footage as may be required by future programs.

In addition to the work benches, the new system utilizes portable work holders for large wiring harness boards. By removing a clip-on shelf from the bench, the assembler can work right at his or her station with easy access to hand tools, soldering irons, parts bins, etc. This portable work holder can be rolled from station to station for progressive assembly steps.

This new assembly system permits a variety of operations—from prefabrication, plaque board wiring, wire jigging, circuit board and harness board assembly to final assembly—to be performed at adjacent stations with greatly improved efficiency. Also, thanks to the modular equipment, an assembly section's configuration can be changed quickly and easily. •

Circuit board assembly station and adjacent seating area require only 16.3 square feet for this type of work.



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Savings – of material and time.

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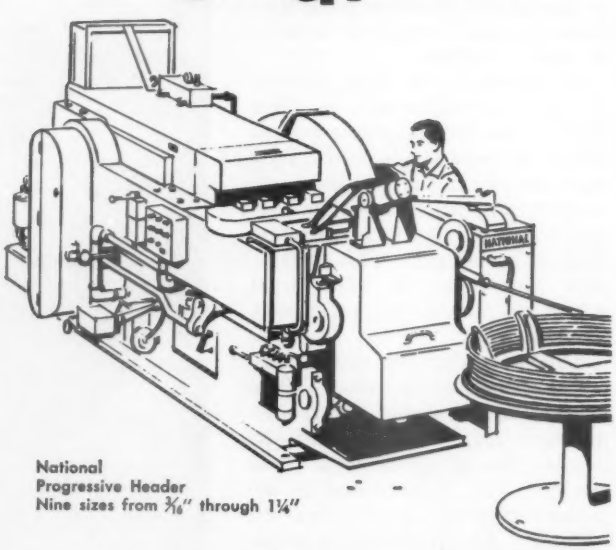

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SELF-LOCKING FASTENER ALSO SEALS

How embedded nylon pellet permits this fastener to meet a variety of applications, including locking against shock and vibration, plus providing for sealing and adjusting.

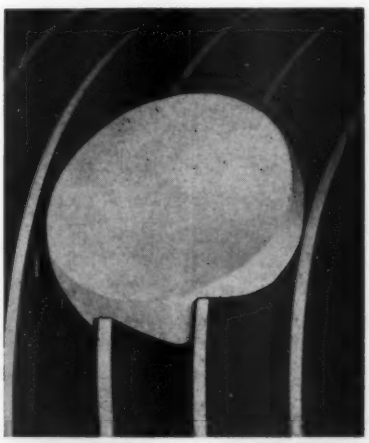
by **Price Berrien**
The Nylok Corporation

Wherever bolts, nuts and screws are applied, they are, according to Webster, supposed "to make fast, fix firmly, attach securely." Yet, who would venture to guess the number of failures and accidents occurring daily in various forms of transportation, in industry, and in the home, which are attributable to the loosening of a fastening device? It was established that the death of Tony Bettenhausen during the 1961 Memorial Day races in Indianapolis was attributable to a bolt failure.

It is obvious that there is no single panacea for this problem of loosening. This is in spite of a tremendous pressure exerted by industry and the enormous research in the area of self-locking devices by the fastener industry. The variety of requirements makes the matter of specifying the appropriate self-locking fastener a matter of intelligent selection rather than reliance on so-called catch-all locking devices.

With this in mind, our company developed, some 14 years ago, the Nylok fastener. This versatile device covers a wide range of applications and meets a variety of physical demands, principally for locking against vibration and shock; for sealing; and for adjusting. The key to its locking ability is a tough resilient nylon pellet embedded permanently in the body of the threaded fastener. For all intents and purposes this pellet can be considered a muscle.

Projecting slightly beyond the crest of the thread, it must be compressed when the mating parts are engaged. When compressed, the nylon pellet sets up a counter-force and creates a strong metal-to-metal engagement of the threads opposite the pellet. This locking action takes place whether or not the fastener is seated. Moreover, the locking action is sustained because of the inherent tendency of nylon to regain its original shape when deformed. This action results in the growth of the nylon into the mating threads providing great resistance to loosening. Nylok fasteners, both male and female, are manufactured to meet the requirements of military specifications.

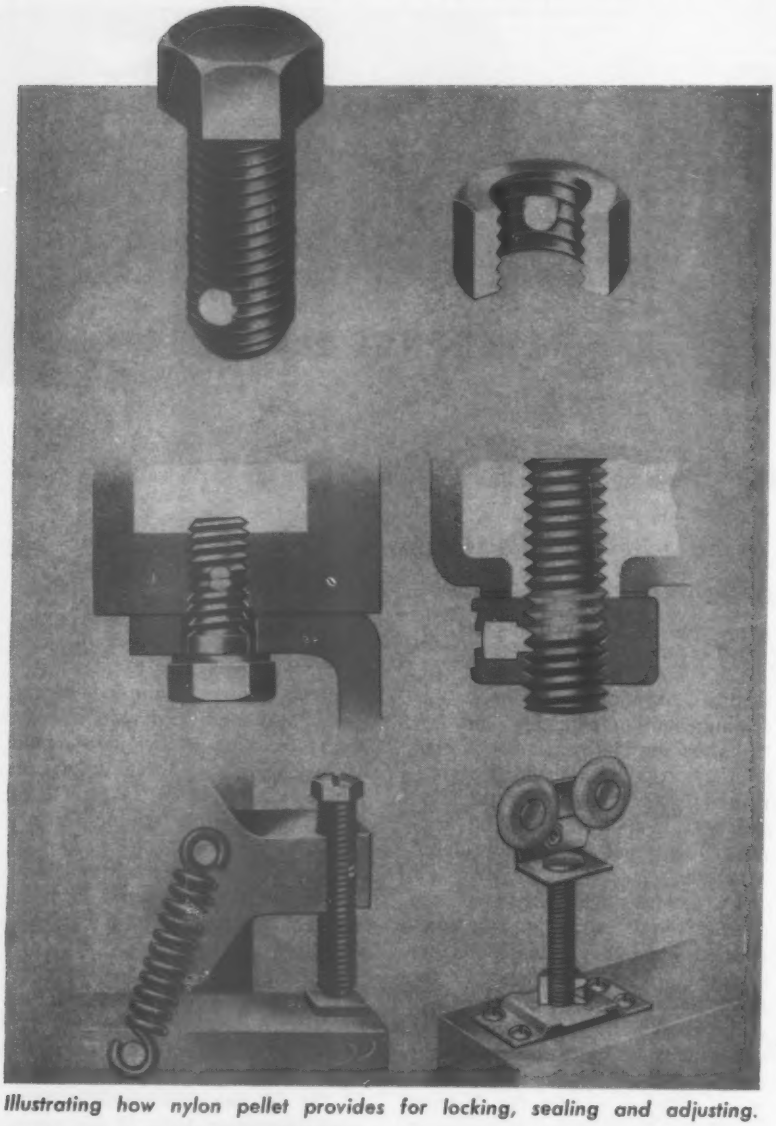


Nylon pellet embedded in the body of threaded fastener exerts cross-thrust to keep fastener locked in position.

How is the nylon pellet, or plug, held in place? When the plug is installed in the male thread, a force-fit drives the plug into the hole under high pressure. Due to the tightness of the fit, the pellet cannot work loose. Since so little of the screw material is removed in drilling the hole, the tensile strength of the screw equals that of a standard screw where it is engaged to a point two full threads beyond the pellet.

In the case of a nut, a two-diameter hole is drilled completely through one of the hex faces. The plug has a diameter intermediate between these two so that it can enter the larger diameter freely but must be forced through the smaller inside diameter. When forced into the small diameter, the plug forms a shoulder upon itself which coincides with the shoulder in the two-diameter hole. When the plug has been inserted to its proper depth, the surrounding material of the part is then staked over the outside of

continued



Illustrating how nylon pellet provides for locking, sealing and adjusting.

Applications of these self-locking fasteners range all the way from kitchen faucets to such missiles as the Minuteman as well as its guidance system.

the nylon plug which is thus held against movement in either direction.

A recent alternate method has been developed for installing the locking nylon pellet in the nut. The pellet hole is drilled from the inside on an angle into the threaded section of the nut without breaking through the outer wall. The pellet is installed by means of a press fit similar to that incorporated in the male fastener. This nut, which is growing in demand, can also be started on the mating thread from either end.

The threaded insert is a good example of the application of this locking principle in both external and internal threads. The nylon plug goes completely through the wall, engaging both threads. The diameter of the plug on the external thread is greater than that on the internal; this gives controlled torque, meaning that the torque developed on the external thread is always greater than that on the internal thread.

The nylon material from which the pellets are punched is specially extruded so that the contoured pellets conform approximately to the major diameter of the male fastener. The plug for the female fastener is cut from round nylon stock of varying diameters as determined by the size of the nut to be pelletized as well as the torque required by the application.

For optimum locking torque the mating thread should be countersunk 90° or 100° by 1/32″ larger than the major thread diameter.

The clearance hole for average commercial applications should be a minimum of .015″ larger than the major thread diameter in order to provide adequate clearance for the pellet protrusion.

Nylok bolts and screws are designed to have at least one full starting thread available even under the worst tolerance conditions. This gives sufficient thread engagement to withstand the axial load imposed by the engagement of the nylon pellet in most mating threads without distorting the first thread in the mating part.

In applications where operating temperatures may exceed 250° F, where keyways or other thread in-

continued

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TYPE OF SHANK	HEX SIZE Nominal	HEX SIZE Actual	TO BE USED IN Socket Head Cap Screw	TO BE USED IN Socket Set Screw	Overall Length	Part Number
1/4" HEXAGON DRIVE	1/16	.062	#1	5 & 6	1-15/16	AM-02
	5/64	.077	#2, #3	8	1-15/16	AM-02A
	3/32	.092	#4, #5, #6	#10	1-15/16	AM-03
	7/64	.108	#6	---	1-15/16	AM-03A
	1/8	.124	#8	1/4	1-15/16	AM-04
	9/64	.139	#8	---	1-15/16	AM-04A
	5/32	.155	#10	5/16	1-15/16	AM-05
	3/16	.186	1/4	3/8	1-15/16	AM-06
	7/32	.217	5/16	7/16	1-15/16	AM-07
	1/4	.249	---	1/2	1-15/16	AM-08
5/16" HEXAGON DRIVE	1/8	.124	#8	1/4	3	AS-04
			#10	5/16	3	AS-05
						AS-06
						AS-07
						AS-08
						AS-10
						AS-12
	3/8	.374				
7/16" HEXAGON DRIVE	1/8	.124	#8	1/4	3-1/2	AN-04
	9/64	.139	#8	---	3-1/2	AN-04A
	5/32	.155	#10	5/16	3-1/2	AN-05
	3/16	.186	1/4	3/8	3-1/2	AN-06
	7/32	.217	5/16	7/16	3-1/2	AN-07
	1/4	.249	---	1/2	3-1/2	AN-08
				5/8	3-1/2	AN-10
						2
						6
						8
						10
						12
						16
						18
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	3/8					
	1/2	.498				
	9/16	.560				
	5/8	.623				

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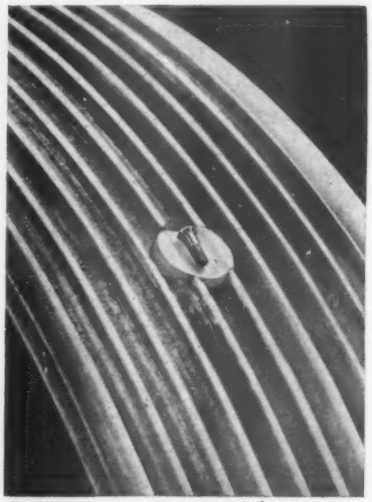
Self-Locking Fastener, continued

terruptions are encountered, special engineering consultation is recommended.



Nylok's range in size is indicated by this photo showing an eyeglass screw resting on pellet insert of threaded section of fastener used in nose cone of a missile.

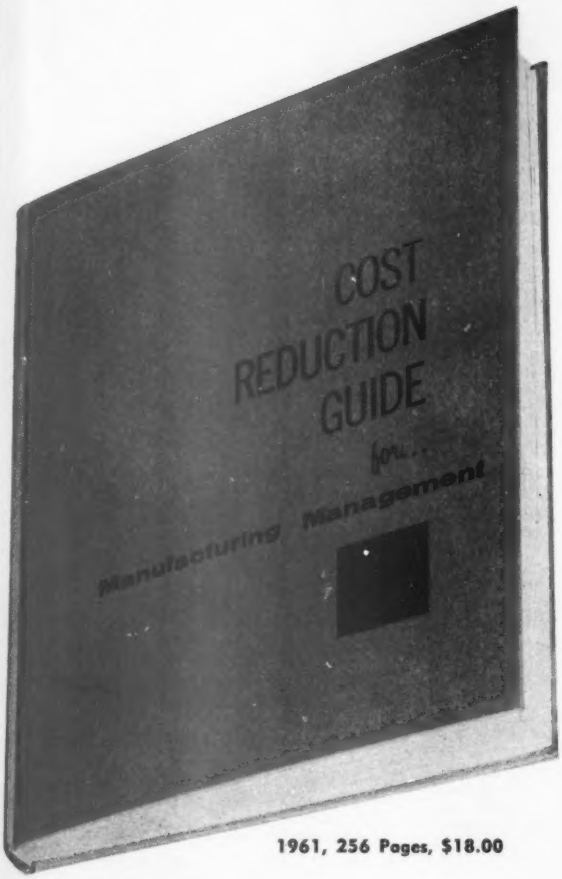
Flexibility in design is another feature of this type of fastener. Variation in the number of pellets, pellet sizes and location can aid in solving certain fastening problems where variations of torque may be required. For reasons of high resistance or low torque, the nylon pellet can be substituted with other materials including teflon, Kel-F, polyethylene, etc.

The range in size of fasteners and special threaded parts requiring nylon pellets is broad because it insures against malfunction caused by loosening of threaded joints. Applications vary from the large fasteners used in giant machinery, through transportation equipment, down to miniature electronic products. A common application is in No. 00-96 screws used in eyeglass frames, for which screws are pelletized in excess of a million a month. A more exacting application was the small pellet developed for the nose cone of the Titan missile. The threaded section approximately 14" in diameter required a very closely controlled torque. In these two widely diversified applications are seen the adaptability and versatility of this type of fastener. ●

THE HOW AND WHY OF EFFECTIVE COST REDUCTION AND ITS EFFECT ON PROFITS

COST REDUCTION GUIDE

FOR MANUFACTURING MANAGEMENT



1961, 256 Pages, $18.00

Written and Published by
H. Clifton Morse and E. E. Wyatt
Wyatt and Morse, Inc., Cost Reduction Specialists

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AS RUDY SEES IT

Got a question, challenge, puzzle to share or story to tell? Shoot it along, we'd like to meet you.

THOSE FRINGE BENEFITS ADD UP

The recent contract negotiations completed by the retail clerks union in Los Angeles include psychiatric services for supermarket clerks and their families. We wonder if the negotiations got along far enough to determine who furnishes the couch, management or labor?

THEY WENT THAT-A-WAY

With the Diesel locomotive replacing the old "iron horse", and motor boats plying the once peaceful Venetian canals, modern technology has played havoc with the writer of romatic fiction. The "plaintive whistle of the steam engine, rolling across the prairie" is a thing of the past. It takes little imagination to realize what the motor boat has done to the romantic gondola. And now, "the thundering hoofs of cattlemen horses, seeking to oust the homesteaders" is the next idea to fall. A re-geared motor scooter called the "iron pony" is now being used by government men to ride the range between Indian reservations in Arizona. About the only thing left for the romantic writer is the time honored "Come with me to the Casbah".

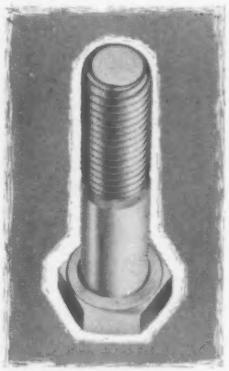
CLOSING THE GAP

It has been reported that a fraternity at an American university won first place in a contest by packing 26 fraternity members in a French compact car. Next year, things will be different. American car manufacturers are promising a bigger compact.

MATH OVER LIGHTLY

An engineer, constructing a model train layout (for his son, of course), wished to fence off two equal adjacent squares of a certain area. His available frontage was two inches short. However by using two more inches of fencing, he was able to fence in the desired area in two squares. What were the sides of the squares? (See answer on page 77)
School Science and Mathematics

UPSIDE DOWN BOLT



In this day of rapidly changing technology, the Dumont Industrial Screw Corp. has engineers constantly working to determine ways to assemble and fasten products faster and at less cost.

Their most recent development is an upside-down bolt.

Since almost every item manufactured today is built from the bottom up, they feel this fastener will develop into one of their biggest items.

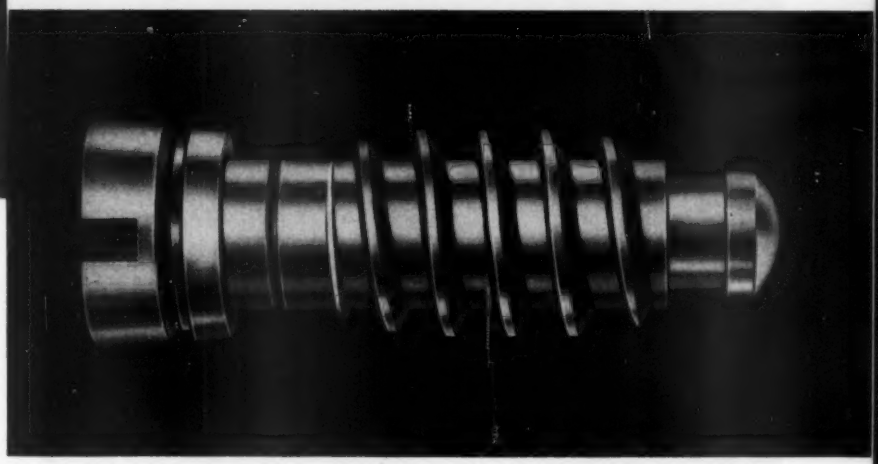
The secret of the new line is that the bolt head is actually manufactured on the bottom end of the shank instead of the top. Time is saved turning older style bolts over, and supervision time is practically eliminated.

LIMERICK CORNER

Call for switch in math teaching—news item.
There one was a teacher, whose name
was Knox,
His system of math, a complete paradox,
The square root of nine,
He'd never define,
Instead, he'd rely on set, theory and
flocks.

Every man takes the limits of his own field of vision for the limits of the world—Schopenhauer

approved
by the
automotive
INDUSTRY



headed for savings

Like many industries, the automobile industry is seeking ways to combat foreign competition. With the cost of raw material and labor firmly fixed, automotive design engineers are seeking ways to increase fabrication speed and thereby reduce cost. They, like many others, are finding the answer to fastener design problems in cold headed parts. Cold heading provides the speed in manufacture essential to low production cost combined with flow strength which can only be maintained when all of the material is cold formed rather than partially cut away. If you are seeking ways to produce quality fasteners at less cost and eliminate the material waste and slow production time found in screw machine parts, why not call the man from GLS? Let him show you how we can cold head quality into precision fasteners for you at less cost. *We're headed for savings.*

GSL

GREAT LAKES
SCREW CORPORATION

EXECUTIVE OFFICES • CHICAGO 27, ILLINOIS

Use postpaid card. Circle No. 235

COSTS CUT 60% WITH NELSON® STUD WELDING

Drilling and throughbolting out! Nelson Stud Welding in! The transition was almost that fast when this Minneapolis manufacturer was shown he could save 60% in the fastening of cover plates to commercial dry cleaning equipment.

Nelson Stud Welding is a fast method of end-welding studs to steel or aluminum. In a split-second, with a squeeze of the trigger, a rugged, secure stud attachment is made. The ease and speed of stud welding lowers fastening costs, increases production. You get lower product weight (no heavy bosses needed), no possibility of leaks in water or oil-tight units, less material handling (the tool goes to the work) and greater design flexibility.

Application ideas, design recommendations and full method information is in the Nelson "Design Manual". Send for a copy today. **NELSON STUD WELDING,** Div. of Gregory Industries, Inc., Dept. AF, Lorain, Ohio.

GREGORY INDUSTRIES

Use postpaid card. Circle No. 237

WHAT'S NEW IN EQUIPMENT

For information on any equipment listed here, use the postpaid card opposite page 76. Just circle the number on the card matching the number following the description. We'll do the rest.

SOLDERING IRONS HAVE QUICK CHANGE ELEMENTS

Production line soldering irons feature cooler and more comfortable handle grip, shorter, better balanced, improved finish, more rugged irons, in 33 different models.

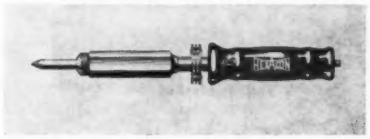
They are particularly adaptable for fast production line soldering.

Included are plug tip irons, hatchet irons and super powered irons, with tip sizes from ⅜" to 1¾"

All irons have quick-change element and terminal with ground wire set screw, so that they can be changed over to 3-conductor cord sets by the user.

Hexacon Electric Co., 635 W. Clay Ave., Roselle Park, N. J.

Use postpaid card. Circle No. 1



See No. 1

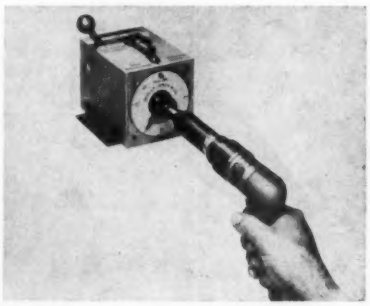
TORQUE SETTING GAGE FOR POWER TOOLS

A precision torque-setting gage which can be used for testing nut runners and screw drivers under power, assures uniformity of tightness in assembly. The portable tester, measures torque-release limits with a repeatability of ±3%.

For hand or power tools utilizing torque-limiting clutches, the tester provides a convenient, quick method of rechecking tools on the job. It is designed to meet the needs of accurate assembly in instrument, missile, and aircraft plants where it is desirable to maintain uniform tightness in fastening operations requiring the use of numerous tools.

Scully-Jones and Co., 1924 S. Rockwell St., Chicago, Ill.

Use postpaid card. Circle No. 2



See No. 2

INSPECTION LIGHT MAGNIFIES & ILLUMINATES

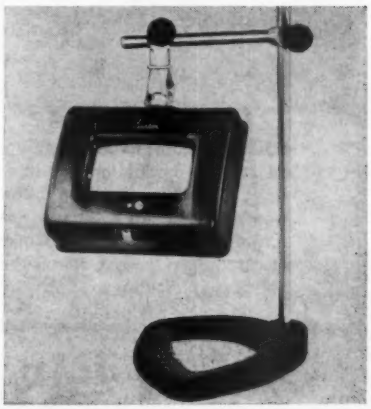
Burton inspection lights that also serve as 3-power magnifiers are now available for general industry. The lights have a soft fluorescent illuminator with a precision-ground magnifier built right into its center.

As a tool for industry, these lights can be used for inspection, miniature assembly, the machine shop and laboratory. Ultraviolet tubes can be substituted, if desirable.

The lamp and lens housing is 6¾" x 5½". The polished lens is 2" x 4" with a 3-inch focal length.

Burton Manufacturing Co., 1918 E. Imperial Hwy., El Segundo, Calif.

Use postpaid card. Circle No. 3



See No. 3

AUTOMATIC UNIT ELIMINATES MANUAL PARTS TRANSFER

An automatic feeding and orienting machine for all types of metal parts is designed to eliminate costly transfer of parts by hand.

The unit is capable of handling up to 1160 pieces per minute. It receives parts or materials from one machine, orients or positions these parts on to the conveyor belt and feeds them to another machine automatically.

It will also feed and orient from a bulk hopper.

Bosworth Manufacturing Co., 34250 Mills Rd., Avon, Ohio.

Use postpaid card. Circle No. 4

HEAVY DUTY IMPACT WRENCH FOR HIGH TENSILE BOLTS

A heavy-duty impact wrench is designed for use on jobs requiring hi-tensile bolt capacity of ¾" to 1¼".

The 990 impact wrench features a patented "roll action" timed impact mechanism. Its operation is not dependent on springs or motor velocity. The impacting blow is engaged and disengaged with precise timing, using the ball-and-race principle. It will maintain positive full engagement regardless of speed or power input.

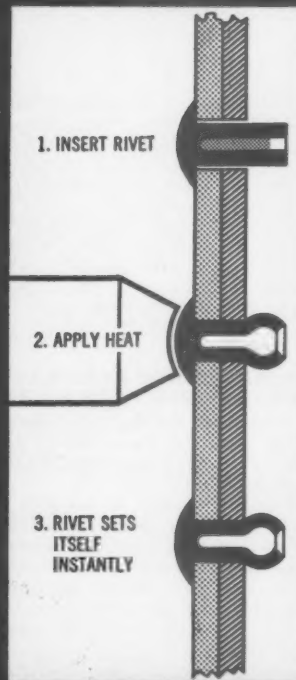
Master Power Corp., Solon, Ohio.

Use postpaid card. Circle No. 5

DIAL ASSEMBLY PRESS HAS VARIABLE SPEED DRIVE

Geneva motion dial assembly press has an 11" diameter plate with 8 stations, and one ton press head with a 2" stroke, and a 3" throat. For bench mounting, this unit has an electric variable speed drive, 18-36 indexes per minute.

NEW DU PONT
EXPANSION
BLIND RIVETS
...safe, simple, economical



- One unskilled operator can set up to 25 per minute... in blind applications.
- Fasten metal, wood, rubber, fibreboard, plastic, tubing, etc.
- No expensive tooling—all you need is a soldering iron.
- Safe, positive sealing; shank expands along full length for wider grip range.
- No finishing operation required.
- Simple, one-piece design.
- Brazier or countersunk head.
- Available in brass, chrome plated brass, aluminum, stainless steel.
- Tamper Proof

Send for details

THE BOWMAN PRODUCTS CO.
Industrial Division
850 East 72nd St. • Cleveland 3, Ohio

Exclusive distributors:
DU PONT Industrial Blind Expansion Rivets

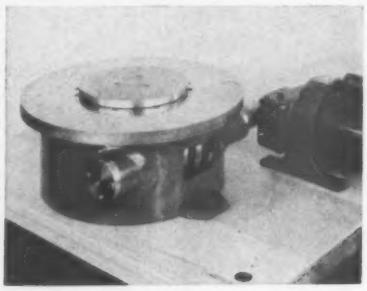
Use postpaid card. Circle No. 238

This machine is available with combination press-stake head, spinning head and welding head also.

Precision Detroit Co., 20100 Sherwood, Detroit 34, Mich.

Use postpaid card. Circle No. 6

NON-ROTATING CENTER FEATURED ON INDEX TABLE



A cam and roller drive index table features a non-rotating center which may be tooled to mount auxiliary equipment for drilling, staking, clamping, inspection and tapping. Smooth acceleration, travel, and deceleration are provided by the cam and roller design.

A transparent access window in the frame permits observation of cam and pins for timing purposes during set up.

Edward Segal, 132 Lafayette St., New York 13, N.Y.

Use postpaid card. Circle No. 7

FEEDER HANDLES WIDE VARIETY OF PARTS

The Model 51 parts feeder is designed to feed parts up to ¼" in length in a 5" bowl and ½" in length in a 7" bowl. Track width of the cast aluminum bowl is 5/16" for a 5" bowl and ½" for 7" bowl. The bowl can be constructed for clockwise or counter-clockwise feed.

The 3,600 electromagnetic vibrations per minute feed even the most delicate parts with minimum risk of damage. Parts are simply dumped into the Feeder's bowl.

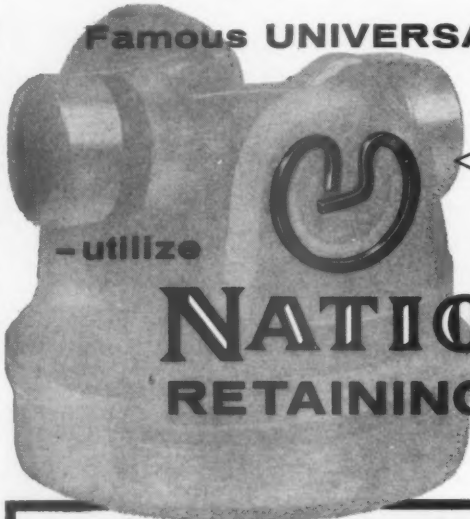
Elk Engineering Works, St. Marys, Pennsylvania.

Use postpaid card. Circle No. 8

SOFT FACED HAMMER HAS INTERCHANGEABLE TIPS

Soft faced hammers are designed to hold interchangeable nylon tips of varying degrees of hardness. The tips, which are color coded to indicate hardness,

Famous UNIVERSAL JOINTS



Spicer

—utilize

NATIONAL
RETAINING RINGS

FOLLOW THE LEADERS! Simplify product designs, reduce weight, space and production operations by installing NATIONAL Retaining rings. Use smaller shafts and housings, save machining and material wasted when larger shafts are cut down to make shoulders. Performance-proven on assemblies ranging from heavy machinery to electronic equipment. Request catalog and recommendations on your specific applications.

The NATIONAL LOCK WASHER COMPANY
Serving Industry Since 1886
NEWARK 5, NEW JERSEY • MILWAUKEE 2, WISCONSIN

Use postpaid card. Circle No. 257

Setko's 23 Years of Progressive Engineering Experience Keeps Screws Modern as Tomorrow's Products

Vol. 4, Issue No. 1

SETKO NEWS

Bartlett, Illinois (Chicago Suburb)

We Specialize in Solving Puzzling Screw Problems

Progress Edition

Extra Tough, Extra Clean, Extra Scale-Free

because only SETKO Screws are Isothermal Heat Treated

THIS HEAT TREATING PROCESS IMPARTS A DISTINCTIVE BLUE-BLACK COLOR WHILE PROVIDING DISTINCTIVE PERFORMANCE CHARACTERISTICS . . . YET, IT COSTS YOU NOTHING EXTRA.

Extensive use has proven that socket screw products treated by this process are tougher and cleaner. Threads, heads, points, shanks, etc. are scale-free. This means better fit, better performance. Also, Isothermal heat treated socket screw products prevent decarburization...and it costs you nothing extra. It's another Setko exclusive in the socket screw field.

NU-CUP POINT SLABBED OR SOCKET HEAD
STANDARD HEXAGON SOCKET SET SCREWS
FLUTED SOCKET SET SCREWS
ZIP-GRIP SELF-LOCKING SET SCREW
HEXAGON SOCKET HEAD CAP SCREWS
only Setko socket screw products have this distinctive, unplated, blue-black color

Standard on most Setko socket screw products

Isothermal heat treating has been adopted by Setko as a standard on most standard and special socket screw products including; hex socket, fluted socket, and slabbed head set screws as well as hex socket cap screws. (Stainless steel screws are generally not heat treated.) Unless you specify otherwise, screws that you order in these primary categories, regardless of points, or locking actions, will be isothermal heat treated. It costs you nothing more for this bonus value extra.

Take the Setko "Look Test"

Compare the unplated finish of Setko socket screws with other products using other methods. You'll see the cleaner, scale-free threads, heads and points that have made Setko socket screw products outstanding in their field. Write for test samples. Send us your specifications and requirements for advantageous quotations.

Isothermal heat treating minimizes distortion

You get low cost, more dependable performance on the production line and in the field — Isothermal heat treated screws have a minimum of distortion. Far less than commonly used methods. Screws fit better, hold tighter. It's the same heat treating method used by manufacturers of precision products such as: razor blades, etc. B-187

Setko engineers will reanalyze your socket screw product requirements

As a part of the continuing Setko program of product re-evaluation, Setko engineers will work with you in determining the best combinations of devices for your specific requirements. All you have to do is send a sample of the assembly with your specifications and they will make recommendations and suggestions, promptly and without delay. Take advantage of this offer today, you may realize substantial savings in increased reliability, lower production costs, or faster, easier assembly methods. Address requests on your company letterhead.

SETKO

Set Screw & Mfg. Co.

705 Main Street, Bartlett, Ill. (Chicago Suburb)

Use postpaid card. Circle No. 239

LOCK WASHER CORROSION RESISTANCE INCREASED and HYDROGEN EMBRITTLEMENT ELIMINATED

When You Specify

MELLOWES LOCK WASHERS

Protected By

DYKO BRAND METAL PLATING
TM 3M CO

Plus Iridescent Chromate Treatment

YOU BENEFIT 3 WAYS

1. NO HYDROGEN EMBRITTLEMENT

The "3M" Mechanical Plating System for depositing "DYKO" plating is non-electrolytic. Both laboratory and production experience has demonstrated conclusively that high strength steel parts, Lock Washers included, can be plated without hydrogen embrittlement. Embrittlement has always been a "nightmare" for Lock Washer users. Broken Lock Washers in completed assemblies created costly and frustrating situations. Long baking after electroplating helped, but even baking was not fool-proof. Now, finally, HYDROGEN EMBRITTLEMENT is no longer a problem.

2. HEAVIER COATING

Heavier, more consistent coatings for the same cost are now possible. MELLOWES standards call for .0003" coating thickness when commercial plating is required.

3. INCREASED CORROSION-RESISTANCE

The protective value of greater coating thickness is enhanced by clear chromate treatment. Clear chromate preserves the true metallic finish of the plating and also adds to its corrosion-resistant qualities. It is standard Mellowes procedure to apply clear chromate to mechanically plated Lock Washers.

However, iridescent chromate (which is bronze-like in color and greatly increases corrosion-resistance) is strongly recommended when the primary reason for plating is corrosion-resistance.

Either chromate treatment is available at NO ADDITIONAL COST!

Get the Complete DYKO Story

For further information on DYKO Metal Plating, write for Illustrated Brochure and Salt Spray Test Graph which explain both the clear and iridescent chromate treatments.

M·C Made in U.S.A.

THE Mellowes CO.

143 EAST NASH STREET • MILWAUKEE 12, WISCONSIN

Manufacturers of a Complete Line of Lock Washers in all Standard and Special Sizes in Steel, Stainless Steel, Non-Ferrous, Plain or Plated in Bulk, Coin Pak, JOB-PAK or Special Packaging.

Use postpaid card. Circle No. 240

are resistant to oil, gasoline and common industrial acids. The soft faces prevent marring of finished surfaces and will not gash, mushroom or chip. These hammers are offered in three head diameter sizes—1¼", 1⅜" and 1¾" and the replaceable tips are available in three grades of hardness.

Armstrong Bros. Tool Co., 5203 W. Armstrong, Chicago 46, Ill.

Use postpaid card. Circle No. 9

AUTOMATIC WIRE STRIPPER HAS HIGH PRODUCTION RATE

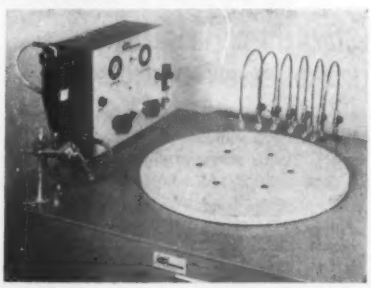
Quick-change devices that greatly reduce set-up times are featured in the Model 810A automatic wire stripper. The new features, designed to simplify set-up changes and eliminate the need for hand tools, include a dial indicator on the measuring device, a slide lock to hold feed rolls in place on keyed shafts, and quick-release clamps to hold strip assemblies in place.

The machine is air-powered and electrically controlled. It cuts and strips 32 to 12 AWG wire in lengths from 1 inch to 300 feet at speeds up to 8,000 pieces per hour. It may be used to strip Teflon, fiberglas, asbestos, and Kel-F as well as PVC, rubber and other soft insulations.

Eubanks Engineering Co., 260 North Allen Ave., Pasadena, Calif.

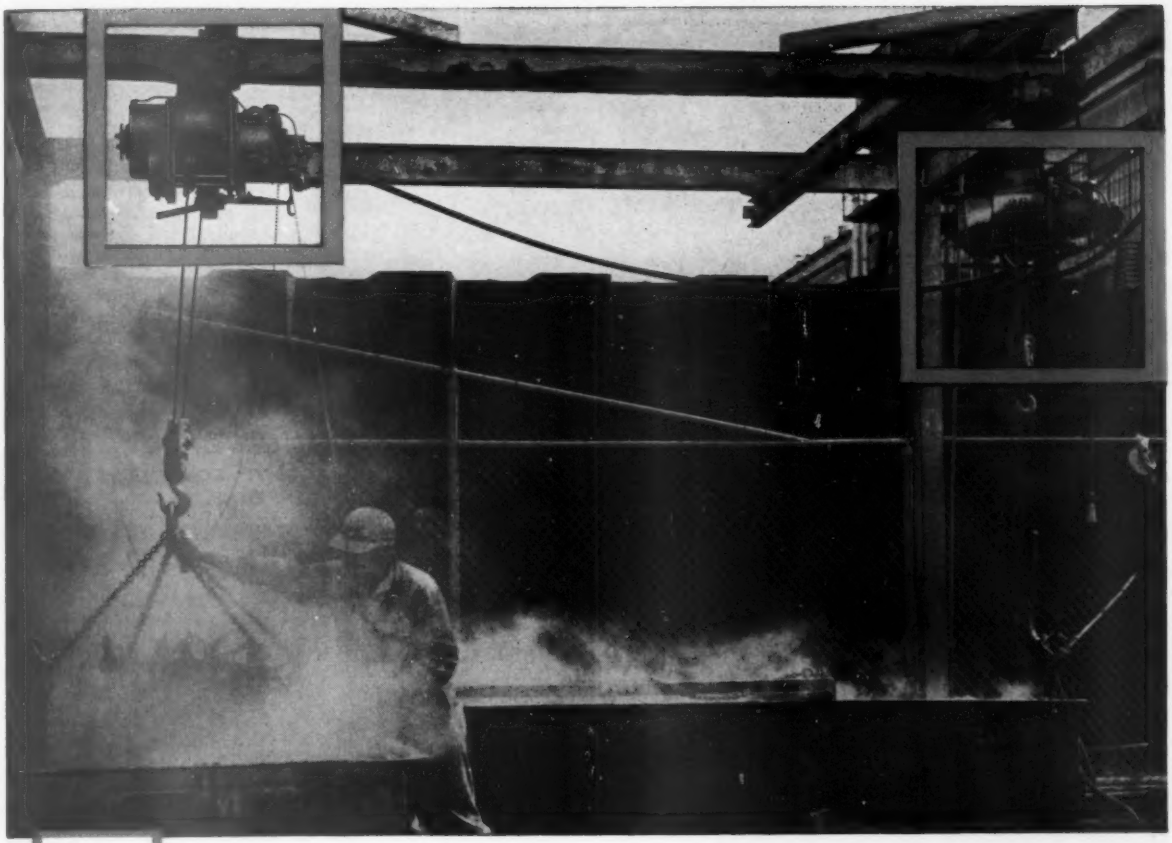
Use postpaid card. Circle No. 10

INDEXING TABLE FOR AUTOMATIC SOLDERING



Standard rotary and indexing tables are completely mounted and tooled for automatic or semi-automatic soldering and brazing operations using the Fusion paste method.

The machines are equipped with paste applicator, natural gas and air



AIR HOIST *is safe from corrosion ... can't cause explosion!*

The air motors that power Ingersoll-Rand AIR hoists are unaffected by fumes, vapors or moisture. Dust and dirt cannot get in to cause premature wear or corrosion and interfere with the hoist's operation. And . . . because the motor is operated by air, not electricity, there can be no sparks which could set off a damaging, even lethal, explosion.

Maintenance of Ingersoll-Rand hoists is unbelievably low—electrical contacts, switches and windings cannot cause trouble because these hoists are powered by air!

PROTECTS LIVES, LOADS, PROPERTY...

Loads can't "run away" even if air supply should fail.

PRECISE FINGER-TIP CONTROL, INFINITELY VARIABLE SPEEDS...

Simple, foolproof, air throttle permits "stepless" speed control of loads.

Over 110 different sizes of Ingersoll-Rand AIR hoists (capacities from 200 to 24,000 lbs.) are available to solve your lifting problems. For details, or a demonstration, call your nearby Ingersoll-Rand representative.

Ingersoll-Rand

11 Broadway, New York 4, N. Y.

Planned Annual Retooling increases output per man

217A-8

Use postpaid card. Circle No. 241

burners, motor driven or air operated tables with two-foot diameter ceramic table top and mounted on steel frames. The tables are capable of handling 200 lbs. of parts.

Fusion Engineering, 17921 Roseland Ave., Cleveland 12, Ohio.

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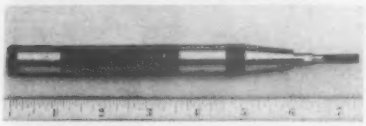
TOOL FOR INSERTING AND EXTRACTING TAPER PINS



A combination tool permits insertion and extraction of taper pin terminals. The Cambion 3060 is rolled from mild steel and knurled at the handle for easy gripping. The tool measures 7½" overall.

Cambridge Thermionic Corp., 445 Concord Ave., Cambridge 38, Mass.

Use postpaid card. Circle No. 12

UNIT SORTS FASTENERS AS TO SIZE OR SHAPE

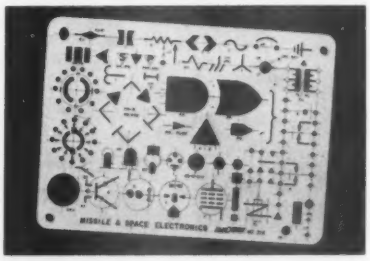
A high speed, precision or gauging machine is used to segregate items according to size or shape. It is extremely flexible and versatile. It can be changed over from one item or size to another by means of a few screw adjustments in a matter of minutes. No change parts are required.

The Precision Sorter is used to sort or gauge items for thickness or diameter such as relay contacts, steel balls, rubber plugs, cylindrical parts, screws, nuts, bolts, beads, small die cast parts, buttons and rivets. The sorter will sort parts such as washers, nuts and disc-shaped objects for thickness only. It will sort cylindrical parts for diameter. Screws, rivets and other headed items can be sorted for head diameter.

Count-O-Matic, Inc., 40-24 22nd St., Long Island City 1, N.Y.

Use postpaid card. Circle No. 13

TEMPLATE FOR ELECTRONIC DESIGN DRAWINGS

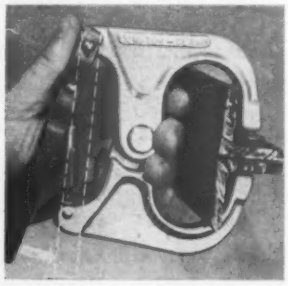


The No. 316 missile and space electronics template has symbols which conform to MIL-STD 70327. The template has been designed for the precision drawing of electronic circuits used in guidance and control of systems of military hardware in space. The template is made of .030 matte finish mathematical quality plastic, and all cut-outs are individually milled for accuracy and smoothness of line. Over-all size is 7" x 5".

Rapidesign, Inc., P.O. Box 429, Burbank, Calif.

Use postpaid card. Circle No. 14

CLAMP LOCKS AROUND UNEVEN SURFACES



A one hand operated over-center locking type C clamp, will lock around two pieces of angle with a firm grip, even on non-parallel surfaces. The clamp opens to 2½" and will clamp to a thickness of ¾".

Price & Rutzebeck, P. O. Box 30, Hayward, Calif.

Use postpaid card. Circle No. 15

NOW! CUT YOUR ASSEMBLY COSTS THESE 5 WAYS

Single Machine Presses and Stakes Automatically

THE NEW CRAMER

PRESSTAKER

SET UP IN LESS THAN ONE MINUTE — cut capital equipment investment, save space.

ELIMINATE SUBASSEMBLY INVENTORIES — assemble from primary components, saving scheduling, parts transfer and tool changeover time.

CUT SCRAP LOSS, DESIGN LIMITATIONS — set close tolerances (within .001!) without risking damage or distortion in staking, even with non-metallics.

USE THE MATERIALS YOU WANT — stake with a tap barely heavy enough to set a tiny eyelet, or with over-one-ton impact.

AUTOMATICALLY — combined press-stake-eject cycle is completely automatic, for production rates to 1400 assemblies per hour.

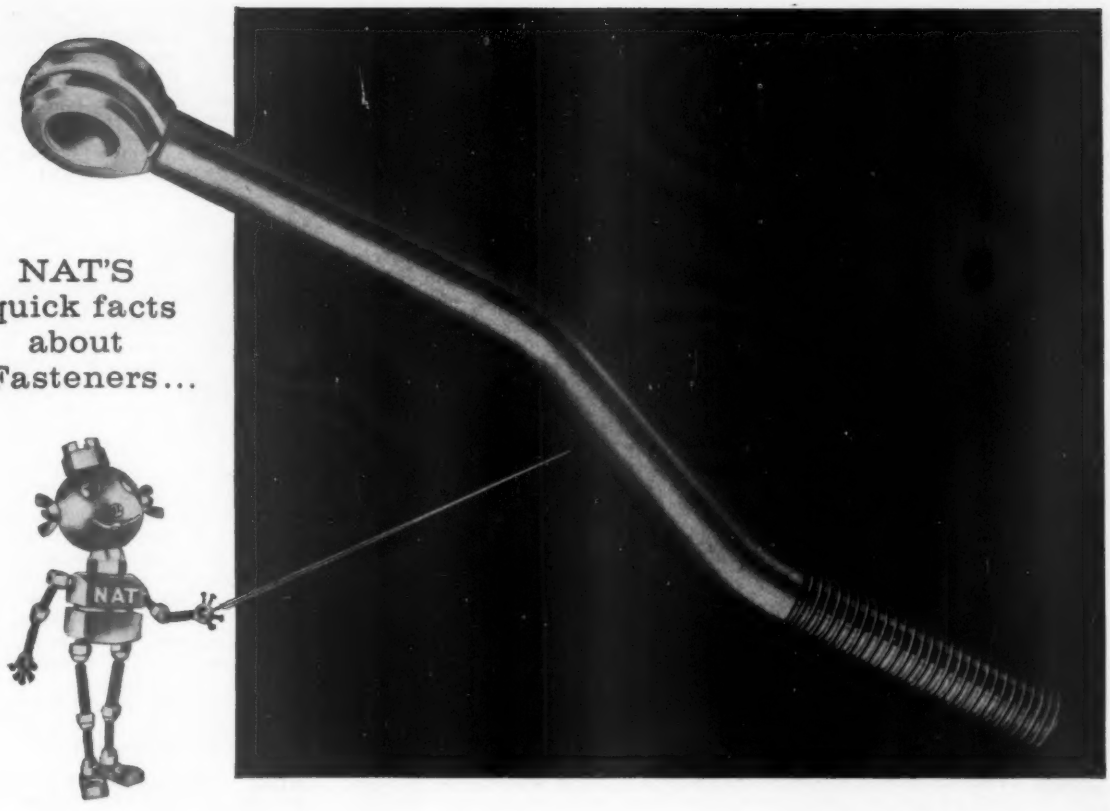
PRESSTAKER is an assembly tool that combines press-fitting with final staking at rates impossible with separate machines. Models available for almost every assembly job. Hundreds in use by companies you know.

LEARN HOW you can turn assembly costs into profits. Send for fact-filled Bulletin A-9.

CRAMER DIVISION — Giannini Controls Corporation — Centerbrook, Conn.

Use postpaid card. Circle No. 242

NAT'S quick facts about Fasteners...



Shining example...of big things in **specials** by National

This is a large offset eyebolt, shown here big as life. We designed and made it to order for one of our customers.

To begin with, it shows that we can and do make some sizable things in the way of cold headed Special Products.

But there's more here than seems to meet the eye.

When our customer brought us this eyebolt, he had been having it made as a forged eye welded to a machined bolt, with a cut thread.

We gave it some thought, then made it... with a difference. We cold formed it in one piece, and rolled the thread... turning out a stronger, more practical, and more efficient part, and lopping off costs all along the line.

And there's the real point... what we really mean when we mention doing BIG things in Specials, at National... better parts, large or small, at lower cost, by cold heading and designing for profit.

We do it right along, and we can very likely do it for you, too. Want to find out? Just drop a note to Special Products Service, at our address*. And if you just happen to have a Special problem, tell us all about it—and let us help.

*It will bring you this illustrated booklet "Bring your Special Problems to National", 16 pages about Specials as National sees them.

National PRODUCTS

The National Screw & Mfg. Company · Cleveland 4, Ohio

California Division, The National Screw & Mfg. Company • 3423 South Garfield Avenue, Los Angeles 22, California

Use postpaid card. Circle No. 229

SOLDERING UNIT LOADS AND UNLOADS AT SINGLE STATION

Fluxless soldering production methods produce uniform results with considerable reductions in cost.

The new furnace has provisions for single station loading and unloading, as compared to a belt type furnace which requires operators at both ends. It has a continuous horizontal closed-loop chain drive with boats onto which actual parts, or preloaded fixtures are placed. The fixtures, holding component elements and solder preforms, move into the furnace where soldering is accomplished under controlled temperature and atmosphere, and return to the same front station where they were originally loaded. The length of the conveyor can be made to accommodate any desired number of operator stations.

BTU Engineering Corp., 179 Bear Hill Rd., Waltham 54, Mass.

Use postpaid card. Circle No. 16

HEAVY DUTY JAWS FOR STUD DRIVERS

Heavy duty jaws are now obtainable for the No. 100 Titan stud drivers sold during the past two years.

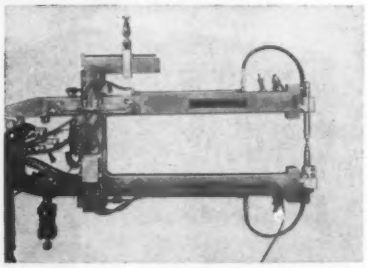
The No. 100 series H. D. are available for No's. 101, 102, 103 and 104 stud drivers. The jaws have four drive ears instead of two as on the standard jaws. In older tools it is only necessary to purchase a new inner body assembly to make use of this improvement.

Titan Tool Co., Main St., Fairview, Erie County, Pa.

Use postpaid card. Circle No. 17

ERIE
BOLTS • STUDS
CAP SCREWS • NUTS
IN ALLOYS
STAINLESS
CARBON
BRONZE
THE CORRECT FASTENER FOR THE JOB . . .
It will pay you desirable dividends in satisfactory results to place your fastener specifications in the hands of specialists. For nearly a half century we have furnished widely diverse industries with fasteners to meet the rigors of extreme temperatures, corrosion, tensiles, fatigue, impact and shear stresses. Send us your specifications for prompt estimate.
This bolt is made special for Oil Refinery Return Bends.
A SUBSIDIARY OF
RIC
ERIE BOLT & NUT CO.
Erie, Pennsylvania

THREE-PHASE WELDING GUN FOR STAINLESS STEEL



A three-phase, portable welding gun with a five foot throat depth is equipped with interchangeable components for both spot welding and roll spot seam welding of stainless steel alloys.

The gun will handle stainless steel alloy work thicknesses from .001 to .125. Utilizing a special three-phase pulse counting control, it meets Air Force specifications for both spot welding and roll spot seam welding.

Progressive Welder and Machine Co., 915 Oakland Ave., Pontiac, Mich.

Use postpaid card. Circle No. 18

HOLE DEBURRING DEVICE PERMITS DEEPER TAPS

A newly developed spring for use on No. 2 to ¾" sizes of Burr-Bit tapped hole deburring device permits deeper tapping. This new type of spring can be used with either the two-lip or three-lip bit.

Vernon Devices, Inc., 481 East Third St., Mount Vernon, N. Y.

Use postpaid card. Circle No. 19

TORQUE WRENCH HAS 600 FOOT-LB. DIRECT READING

A high capacity torque wrench allows direct reading of up to 600 ft. lbs. of torque. The operator need apply only 120 lbs. of pressure to obtain the 600 ft. lbs. reading, and 60 lbs. of pressure to exert 300 ft. lbs. of torque.

Precision torque application is obtained through a sensory signaling device, which provides a "momentary release" imparting pulse to the operator's hand.

The S-600 wrench weighs less than 17 lbs., and has a standard ¾" male drive square.

P. A. Sturtevant Co., Addison, Ill.

Use postpaid card. Circle No. 20

COATED . . .

to seal out moisture

Whether you need a tapping screw that's coated to seal out moisture . . . a spinlock screw that vibration can't budge . . . a hose-clamp screw in carbon steel or stainless—call on National Lock. Utilize our design-engineering service to solve your fastener problem at lowest cost. National Lock's diverse production capacity is geared to satisfy all your standard and special-purpose screw requirements. Fasteners to your exact specifications . . . delivered when you need them . . . in the quantities you require. Write us.

NATIONAL LOCK

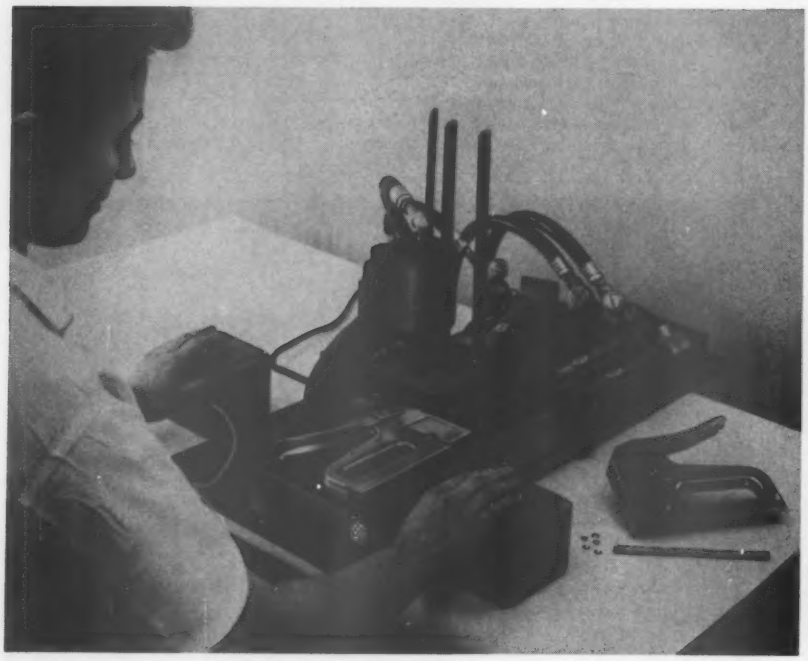
INDUSTRIAL HARDWARE DIVISION • NATIONAL LOCK COMPANY • ROCKFORD, ILLINOIS

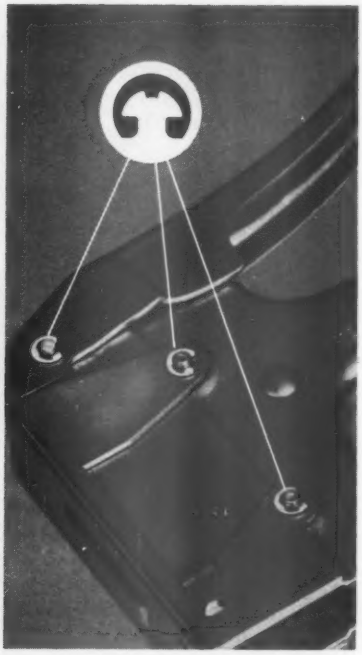
INTERNATIONAL DIVISION • 13 E. 40TH ST., NEW YORK, N.Y. • CABLE: ARLAB

FASTENERS • HINGES • CATCHES • PLASTICS • LOCKS • APPLIANCE HARDWARE . . . ALL FROM 1 SOURCE

Use postpaid card. Circle No. 244

Here's how ARROW FASTENER Co. gets Truarc® Retaining Rings FREE!





U.S. PAT. NO. 2,837,812

Mechanized Ring-O-Mat® designed by Truarc Engineers doubles stapler production for saving of $2500/year

Arrow Fastener Co., Inc., Brooklyn, N. Y., uses three Truarc Series 5144 reinforced E-rings to secure components in its Model T-50 compression stapler. Originally, Arrow operators installed the rings by hand with conventional applicators and dispensers. Fast? Sure — but Truarc engineers suggested to the company how the job could be done even faster and more economically by mechanizing the entire ring assembly operation.

Working closely with the Arrow engineering and production staff, Truarc mechanization engineers designed the unique Ring-O-Mat shown above. The unit installs the three E-rings in a single operation, twice as fast as the former hand method. Savings with the equipment are $2500 a year — enough to pay for all the rings the company uses!

Here's how the Ring-O-Mat works. The Truarc rings are supplied in tape-wrapped Rol-Pak® cartridges which are loaded on vertical magazine rails at the center of the unit. To install the rings, the operator merely places the stapler in a nest at the front and pushes the control buttons . . . the Ring-O-Mat does the rest! Applicators connected to the air cylinders grasp the bottom ring in each stack and move forward, seating the rings in accurately located grooves pre-cut in pivot pins extending through the body of the stapler. When the rings are fully seated, the applicators are withdrawn automatically and the operation is completed. Simple, fast, fool-proof — a typical example of how Truarc retaining rings lend themselves to mechanized assembly. A good example also of how you get *more* than a fastener when you buy Truarc!

Interested in getting your retaining rings FREE?

Bulletin 459-13 describes a number of assembly techniques for mass-production ring installation. Write for a copy or see your Truarc representative.

WALDES KOHINOOR, INC.

47-16 Austel Place, Long Island City 1, New York

51-5

Use postpaid card. Circle No. 245

WHAT'S NEW IN FASTENING AND JOINING

For further information on any of the fasteners or methods use the handy postpaid card opposite page 76.

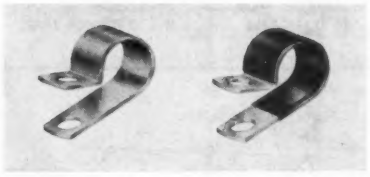
CABLE CLAMP WITH STRAIN RELIEF FEATURE

Two styles of metal clamps have been added to a line of plastic clamps for cord, cables and tubing. They are made of aluminum, and easily assembled.

The Type NE clamp with a flame-resistant neoprene cushion, holds the cord or tubing with a positive non-sliding grip that prevents any strain on connections. Because of its cushioning action, cutting, and scraping of cord insulation is minimized. The neoprene is oil-resistant and will maintain its natural qualities over a wide temperature range.

Richco Plastic Co., Dept. AE-3, 3722 West North Avenue, Chicago 47, Ill.

Use postpaid card. Circle No. 31



See No. 31

SELF-LOCKING BOLT HAS GREATER RELEASE TORQUE

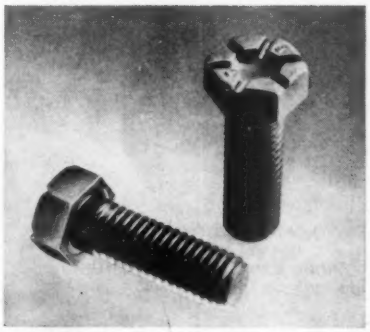
A one-piece, self-locking, free-spinning cap screw, requires greater release torque than other types of fasteners.

In vibration tests, a 3/8" dia. Place Bolt, demonstrated a 21% increase in release torque.

Principal applications for the bolt include installations in gasoline and diesel engines, farm implements, auto and truck chassis and axel parts, compressors and ordnance vehicles.

Screw and Bolt Corporation of America, P.O. Box 1708, Pittsburgh 30, Pennsylvania.

Use postpaid card. Circle No. 32



See No. 32

ASSEMBLY SPEEDED WITH CLIP ON FASTENER

A clip-on, self-locking fastener has application such as attaching flooring, sound proofing and fairings in aircraft. It can be used effectively for many other types of sheet metal or fiber glass assemblies for missile and electronic end-use, as long as the .020" thickness of the clip can be tolerated between the mating surfaces.

See No. 33

Featured in the LHA 4972 fastener design is a locating eyelet formed on the base plate, which snaps into the hole drilled or punched in the sheet.

Presently available in 10-32 size, carbon steel, other sizes are in design. Locking torque and tensile of the fastener is to MIL-N-25027.

Elastic Stop Nut Corp. of America, 2330 Vauxhall Rd., Union, N.J.

Use postpaid card. Circle No. 33

NON-FLAMMABLE PRESSURE SENSITIVE ADHESIVE

A non-flammable, permanently tacky, water dispersible, pressure sensitive adhesive air dries to a clear, transparent film in 20 to 30 minutes. It applies easily by brush, roller coater or spray.

Films of Adhesive 215, even when dried, can be removed by soaking with water. The dried films of this adhesive will lose its tackiness if it is moistened; if the film is then permitted to dry, it will regain its tackiness.

The adhesive adheres to Plexiglas, polyethylene, vinyl, wood, metal, fabrics and glass.

Robert Langer Co., 507 Fifth Ave., New York 17, N.Y.

Use postpaid card. Circle No. 34

METAL FASTENER EASES STOCK IDENTIFICATION

A metal tag fastener is designed to provide swift, secure attachment of tags to products. The metal Ziplock fastener will hold attached cards "face out," making identification easier.

American Tag Co., Dept. 104P, 151 Cortland St., Belleville, N.J.

Use postpaid card. Circle No. 35

THREAD LUBRICANTS NOW AVAILABLE IN TUBES

A thread lubricating compound is now available in handy 8-ounce tubes. This compound reduces wrench torque in the make-up of "bite" type tube fittings such as Ferulok. The compound

WHEN SPACE IS LIMITED AND WEIGHT IS A FACTOR

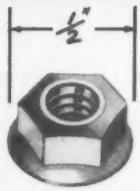
A NEW MAC LEAN-FOGG LOCKING FASTENER

WHIZ-LOCK FLANGETTE

SMALLER !

The new M-F Flangette Lock Nut is much smaller than ordinary flange nuts, yet is structurally strong, locks dependably, simplifies assembly.

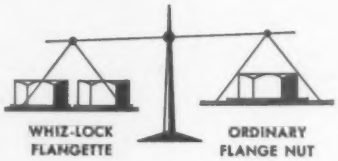
No. 10 FLANGETTE



No. 10 FLANGE NUT

LIGHTER !

Keep weight down with the M-F Flangette. The tiny flange strengthens the entire nut . . . permits lighter body. Weight: considerably less than the conventional flange nut of equivalent size.

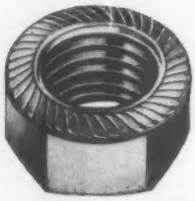


WHIZ-LOCK FLANGETTE

ORDINARY FLANGE NUT

SAFE, SURE LOCK !

The "Flangette" utilizes the patented MacLean-Fogg Whiz-Lock principle. Spins on—locks to the surface on which it bears. Easiest of all lock nuts to apply. Withstands shock and vibration.



WHIZ-LOCK FLANGETTE UTILIZES M-F PATENTED WHIZ-LOCK LOCKING PRINCIPLE

AVAILABLE IN 4 SIZES: No. 6, No. 8, No. 10, 1/4"

SAMPLES ON REQUEST

MAC LEAN-FOGG

MacLean-Fogg Lock Nut Company

5535 N. WOLCOTT AVENUE

CHICAGO 40, ILLINOIS

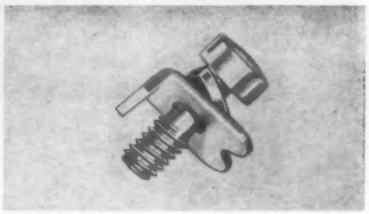
Use postpaid card. Circle No. 246

provides a protective film that prevents galling in stainless steel parts.

Parker Fittings & Hose Div., Parker-Hannifin Corp., 17325 Euclid Ave., Cleveland 12, Ohio.

Use postpaid card. Circle No. 36

STAINLESS SERVO CLAMP MEETS MILITARY SPECS.



A stainless steel servo clamp assembly meets all applicable military specifications, and is made equal to BUORD drawing 643019.

The 6086 clamp is one of a series of clamps available from company stock, and is furnished in a black oxide finish.

Vemaline Products Co., Franklin Lakes, New Jersey.

Use postpaid card. Circle No. 37

NO GUN ADJUSTMENT NEEDED FOR NEW RIVET SERIES

Two additional series of rivets can be used in the "Snapo" rivet gun without having to make any adjustments or changes in the jaw of the tool. The new rivet series are in the 5/32" and 3/16" size, and have been added to the firm's line of ⅛" rivets.

The series feature the aluminum rivet with a steel mandrel, flat head type, and are offered in several different lengths for varying work thicknesses. The ⅛" series are available in countersunk and flat head and with different combinations of aluminum or steel rivets and mandrels.

Richline Company, Inc., Minneapolis, Minnesota.

Use postpaid card. Circle No. 38

COMPANY OFFERS SMALL SIZE PLASTIC FASTENERS

Small sized plastic fasteners machine screws, nuts, and set screws have been added to line of Nylo-Fast products.

The new sizes include 0-80 by 3/32 inch through ⅜ inch, and 1-72 by ⅛ inch through ½ inch. Machine screws contain standard slotted heads. Set

Use postpaid card. Circle No. 247

Fasteners

. . . keep "upkeep" costs *down!*

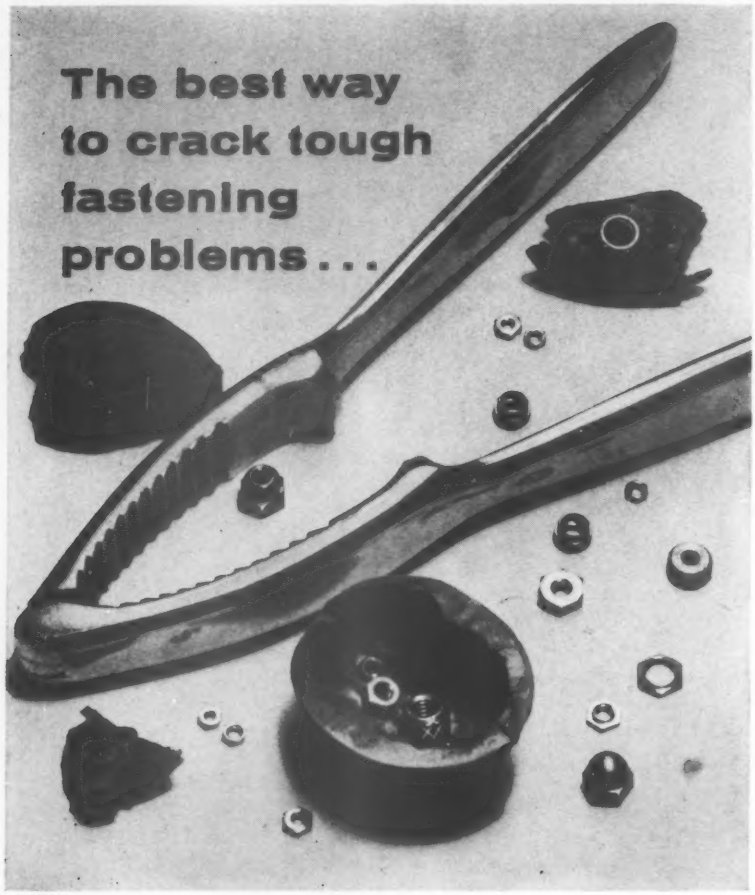
Sure you may be able to buy cheaper fasteners than Mac-it. But, it's not the first cost that counts—it's the "upkeep." How much, for instance, do fastener failures cost you? Now you can eliminate those failures by standardizing on Mac-it!

- **More holding power**—quality materials and workmanship, exact, dimensionally controlled heat treatments put extra *inner strength* in Mac-it fasteners.
- **Precise threads and key surfaces**—uniform, fully formed Class 3A threads and clean, full bearing key surfaces give Mac-it fasteners *maximum* torque, *minimum* wear.
- **Complete line**—no short line "feather merchant" can match the full range of sizes and types that Mac-it keeps in stock to give you fast service of *what* you want—*when* you want it!

For prompt delivery of all standard and special fasteners and precision-ground dowel pins, see your Mac-it distributor. Remember, Mac-it fasteners keep your "upkeep" . . . down!

MAC-IT PARTS COMPANY
LANCASTER 2, PENNSYLVANIA

Blueprint specials—our engineers want to help you in developing fasteners to match your needs. Shown here are some typical Mac-it "specials."



10134-FS

specify *Fischer* miniature turned nuts

Complex miniaturized components for the electrical/electronic industry pose critical assembly problems . . . problems that can be solved successfully with miniature turned nuts by Fischer! Produced with Fischer's exclusive customized equipment and advanced production techniques, these turned nuts meet and surpass existing industrial standards. Today, Fischer leads the fastener industry in fabricating miniatures to meet special requirements at competitive prices. Offering the ultimate in accuracy and uniformity, these nuts are tapped square to Class 2 and 3B tolerances in sizes ranging from ⅛" hex, including standard or custom sizes and shapes with special or standard threads from No. "O". Ask Fischer to quote prices and delivery on your next order for precision miniatures . . . you'll be glad you did!

WRITE TODAY FOR BULLETIN M-600

there's no premium for precision at

Fischer SPECIAL MANUFACTURING CO.

496 MORGAN STREET • CINCINNATI 6, OHIO

Use postpaid card. Circle No. 248

screws are of the slotted headless type. Only restriction in nut sizes is a 1/16" minimum thickness.

Anti-Corrosive Metal Products Co., Inc., P. O. Box 1894, Albany 1, N. Y.

Use postpaid card. Circle No. 39

WIDE FLANGED INSERT FOR MOLDED PLASTIC USE

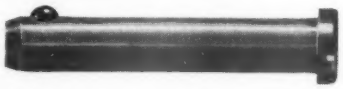
An expansion insert provides a large bearing surface for electrical connectors and a hold-down feature for mating parts in molded plastic. The Dodge Flange insert has a wide flange flush with the upper end to provide the bearing surface and hold-down features.

Properly installed, the 6-32 insert will withstand 18 in. lbs. of torque and 240 lbs. of direct pull-out.

Phelps Manufacturing, Div. Heli-Coil Corp., Shelter Rock Lane, Danbury, Conn.

Use postpaid card. Circle No. 40

SELF LOCKING PIN FOR BLIND ASSEMBLY USE



Cotterless clevis pin is a self-locking type pin with the main body of cadmium-plated steel and the working parts of stainless steel. It is used especially for blind assembly or where the connections are made and separated quite often.

The Leitzke Cotterless Clevis Pin can be furnished in practically all sizes, with one or several locking devices as required in the body. They are produced to specifications upon application. Rein Leitzke, Department CC, Hustisford, Wis.

Use postpaid card. Circle No. 41

HOT MELT PLASTIC FOR PARTS MASKING

A hot melt plastic masking material, which is applied by dip method, is reusable up to six times.

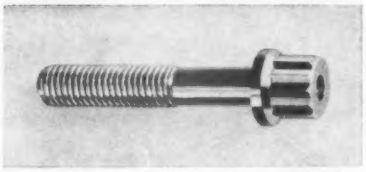
The plastic is ideal for large or small parts, and is recommended for use in bright chrome, hard chrome, lead indium, copper and silver plating.

It is non-toxic, and is easily used by the average worker. It does not crack, craze, cobweb or divert electrical current.

Evens-Thompson Mfg. Co., Inc., 11360 Kaltz Ave., Center Line, Mich.

Use postpaid card. Circle No. 42

EXTERNAL WRENCHING BOLTS IN MINIATURE SIZES

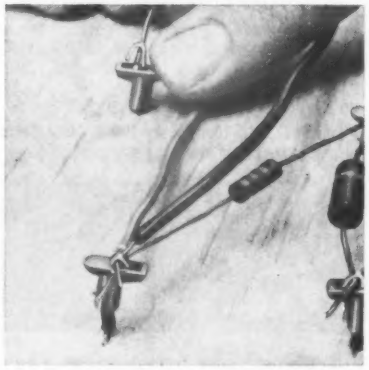


Line of 12-point external wrenching bolts has been revised to include instrument sizes. In addition to the use of high-tensile and high-temperature resistant materials, these parts are now available in high-strength aluminums, brass, expandaloy and non-magnetic grades of stainless steel. The external wrenching head will accept standard box and socket wrenches and offers advantages in high torquing for greater preloads where required

Mercury Air Parts Co., Inc., 9310 Jefferson Blvd., Culver City, Calif.

Use postpaid card. Circle No. 43

CLIP READILY POSITIONED FOR HARDNESS BOARDS



A nail clip is especially designed to provide a quick, convenient terminal for breadboard layouts, demonstration boards, and experimental hookups built on plywood boards or similar material.

It is also ideal for use on hardness boards. The clamping action of the E-Z-Hook connector and the "drive-in" design provides an ideal combination for use in making all kinds of hardness cable assemblies.

E-Z-Hook Test Products, 1536 Woodburn Ave., Covington, Ky.

Use postpaid card. Circle No. 44

ENGINEERING KIT FOR SOLDERING APPLICATIONS

A production engineering kit for industrial soldering applications, is now available for determination of costs using Fusion paste solders. The kit will

the combination makes all the difference!

Milford specializes in both rivets and rivet setting machines. This benefits you in three ways:

1. Milford engineers help you determine not just a fastener, but the correct rivet for your assembly requirements. It may be semi-tubular, full tubular, split or compression; it may be a particular steel, brass, aluminum or alloy; it may be plain, plated, japanned or anodized.

2. The rivet setting machine and tooling recommended by Milford will be ideally matched to the parts to be assembled and specifically geared to the volume you run.

3. Get the combination that gives you lowest "in-place cost"— Milford rivets and Milford machines — for uninterrupted, quality production.

We'll be glad to quote on your needs immediately.

THE MILFORD RIVET & MACHINE CO.
MILFORD, CONNECTICUT • NORWALK, CALIFORNIA
ELYRIA, OHIO • AURORA, ILLINOIS • HATBORO, PA

Use postpaid card. Circle No. 249

ALL Bristol socket screws are available with NYLOK*

provides a self-locking grip against loosening due to vibration

For maximum reliability under severest conditions, Bristol offers its complete line of socket screws with the famous NYLOK self-locking inserts, including Bristol Multiple-Spline and hex socket set screws, socket-head cap screws, flat-head socket cap screws, button-head socket screws, socket shoulder screws, and socket pipe plugs. Here are their big features:

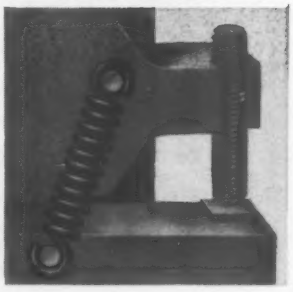
They LOCK

. . . Bristol socket screws with patented NYLOK principle *lock* by means of a tough nylon pellet, permanently imbedded in the screw body. The pellet projects slightly beyond the crest of the threads and is compressed when the screw is inserted, setting up a counter-force that creates a strong engagement of the threads opposite the pellet. All necessity for lock washers, or other auxiliary holding devices, is eliminated.

They SEAL

The NYLOK nylon pellet acts as a dam along the threads of the Bristol socket screw and positively stops all fluid leakage . . . far superior in this respect to ordinary screws which permit fluid leakage along a spiral path between the non-load-bearing thread flanks of screw and threaded hole.

They ADJUST

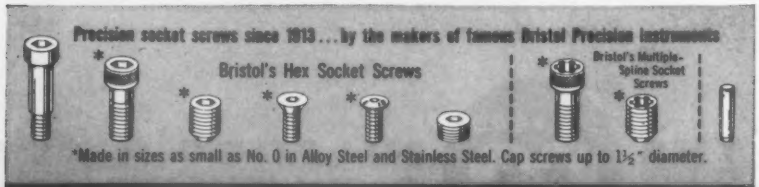


. . . and stay adjusted, time after time. Bristol-NYLOK socket screws make ideal adjusting screws because they provide the same effective locking action regardless of whether they are fully seated. And, the pellet's resilience makes it possible to change adjustments with ease and accuracy.

ACCO

Get full data on Bristol socket screws with NYLOK today . . . and remember, Bristol still offers the most complete socket screw line on the market, both plain and with NYLOK. See your authorized Bristol distributor or write the address below. A.O.11

T.M. Reg. U.S. Pat. Off. The Nylok Corporation.


Precision socket screws since 1913 . . . by the makers of famous Bristol Precision Instruments
Bristol's Hex Socket Screws
Bristol's Multiple-Spline Socket Screws
*Made in sizes as small as No. 0 in Alloy Steel and Stainless Steel. Cap screws up to 1½" diameter.

THE BRISTOL COMPANY Socket Screw Division Waterbury 20, Conn.

A SUBSIDIARY OF AMERICAN CHAIN & CABLE COMPANY, INC.

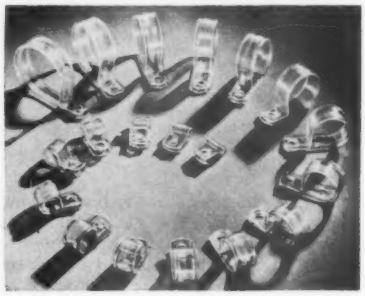
Use postpaid card. Circle No. 230

also help determine the proper paste to be used in hermetic sealing or general duty production soldering operations. The kit is priced at $15.00.

Fusion Engineering, 17921 Roseland Ave., Cleveland 12, Ohio.

Use postpaid card. Circle No. 45

BUTYRATE CABLE CLAMPS FOR OUTDOOR APPLICATIONS



A line of butyrate cable clamps, ultraviolet stabilized for weather resistance, provide excellent cable support and long life, even with continuous exposure to sunlight, moisture, industrial atmospheres and temperature extremes.

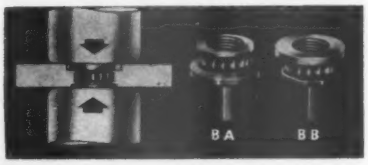
The materials used in the 6B clamp showed no commercially objectionable deterioration. Continuing tests in other areas also indicate greatly extended service life.

The butyrate formula used is approved under Military Specification L-P-349a, Type III—Class MH.

Weckesser Co., Inc., Dept. AE-3, 5701 Northwest Highway, Chicago 46, Ill.

Use postpaid card. Circle No. 46

FLUSH MOUNTED FASTENERS MEET MILITARY SPECS



Flush mounted pressure displacement fasteners, made of alloy steel, are used for installation into ductile material with standard punch press procedures.

BA and BB types meet requirements of MIL-N-25027. These fasteners are available for sheet thicknesses of from .040" through .180" and in thread sizes ranging from 2-56 through ¼-28. Material is high carbon steel, cadmium plated per QQ-P-416, Type II, Class 3.

Stake Fastener Co., 1710 Potrero St., South El Monte, Calif.

Use postpaid card. Circle No. 47

CONTACT CEMENT BONDS PLASTIC LAMINATES

A general purpose industrial adhesive has been used successfully for bonding plastic laminates to wood, metal, plastic or glass surfaces.

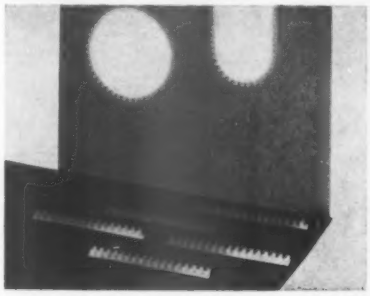
CA-25 contact cement is described as

a synthetic rubber base solvent type adhesive of excellent tack, forming an immediate and permanent bond without the need of sustained pressure from clamps or presses. The adhesive strength is obtained without the use of heat, and the permanent bond improves with age.

Miracle Adhesives Corp., Bellmore, L. I., New York.

Use postpaid card. Circle No. 48

NYLON GROMMETS FIT WIDE VARIETY OF OPENINGS



With three sizes available from stock, nylon caterpillar grommets can be supplied to fit 10 ga to 24 ga steel or aluminum sheets. The Pipcat grommet has a standard length of 10", and can be cut to whatever length is required. For opening larger than 3" diameter, several lengths may be used in combination.

The material used in the grommet meets MIL-P-17091-B, latest revision.

Plastiglide Manufacturing Corp., Dept. P-2, 1757 Stanford St., Santa Monica, Calif.

Use postpaid card. Circle No. 49

LOW PRESSURE SPRAY ADHESIVE SPEEDS ASSEMBLY

An adhesive which can be sprayed at 5 psi, as contrasted with the 40 to 50 psi pressures normally used, provides excellent adhesion of insulating materials to metal and plastic panels.

A one surface adhesive, Spraygrip is sprayed on ready for immediate assembly, although open time is long enough to allow positioning of a variety of large and small component pieces.

Anchor Adhesive Corp., 36-23 164th St., Flushing 54, N. Y.

Use postpaid card. Circle No. 50

LOWER BOLT & FLANGE LOADS REQUIRED BY SEAL

A cryogenic metal seal provides leakproof sealing through high and low extremes of pressure. The Naflex seal requires lower bolt and flange loads than those necessary for most other type seals.

Standard cryogenic seals in aluminum with Teflon covered sealing points, are available in sizes ranging from one to twenty inches.

Rocketdyne, Division of North American Aviation Inc., 6633 Canoga Ave., Canoga Park, Calif.

Use postpaid card. Circle No. 51

UTICA

YES, WE DO HAVE YOUR SIZE

A giant 14" plier has now been added to Utica's famous "Rib-Joint" line. This powerful tool with parallel jaw opening of $2\frac{13}{16}$", completes Utica's full line of "Rib-Joints". All are available from stock. We serve our customers by carrying the widest assortment of pliers. All have been developed for specific uses. All are made to the high standards required by American industry. If you use pliers, ask to see our new catalog.

Utica Drop Forge & Tool Division, Kelsey-Hayes Company, Utica 4, N. Y.

tools the experts use!

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Type 316

Type 316

story of two bolts...

Both of the bolts shown above were used on the *same* application, in the *same* factory, and faced the *same conditions*.

The bolt on the left is a Harper type 316 Stainless Steel bolt shown after three years of service. The bolt on the right is another manufacturer's bolt, identified as type 316 Stainless Steel, shown after only three months of service.

The dramatic fact that the Harper bolt lasted twelve times longer (and is still in service) is proof of Harpers' metallurgical control of alloys from "billet to bolt" in our completely integrated factory. Harper's corrosion-resistant fastenings, immediately available in a wide range of alloys and sizes, assure you that *your* products will be built to last no matter what the application may be.

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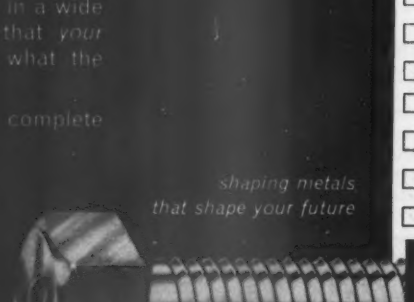
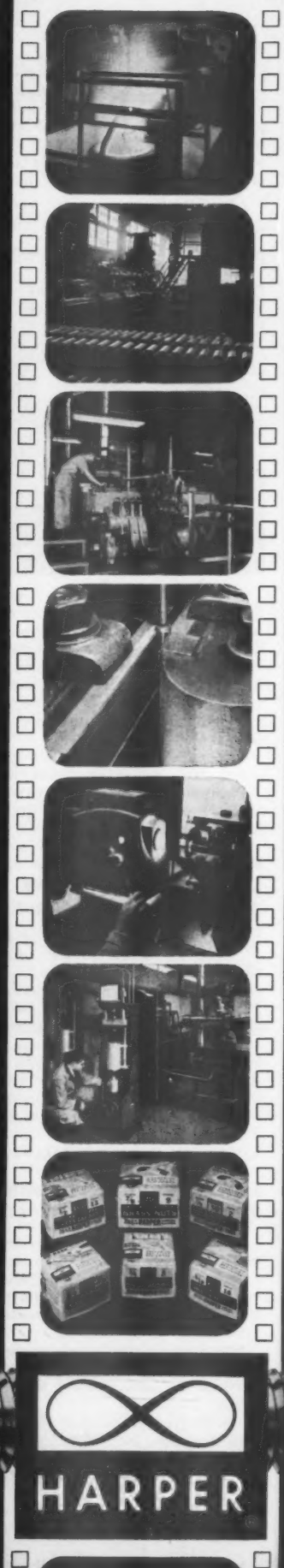
Write today for free copy of Harper's new "Strength" booklet —a factual treatise on important fastening metallurgy.

shaping metals that shape your future



THE H. M. HARPER COMPANY
8200 Lehigh Avenue • Morton Grove, Illinois



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USEFUL LITERATURE

To receive your copy of any literature reviewed here, use the postpaid card opposite page 76.

POWER CONVEYORS

Reference book devoted entirely to powered conveyors incorporates the indexing features of a catalog and the factual presentation of an engineering handbook. A complete, ten-page section is devoted to photographic coverage of actual conveyor installations. Lamson Corporation, Lamson St., Syracuse 1, New York.

Use postpaid card. Circle No. 61

PRESSURE SENSITIVE TAPE

Guide to pressure-sensitive tapes gives handy reference data on full line of paper masking tapes, packaging tapes, protective coverings, high-low temperature tapes, electrical tapes, printable tapes, and specialties. Typical applications are suggested. The guide is pocket-sized for convenience. A quick reference index speeds up the selection of tapes. Industrial Division, Mystik Adhesive Products, Inc., 2635 N. Kildare Ave., Chicago 39, Ill.

Use postpaid card. Circle No. 62

VINYL-ALUMINUM LAMINATE

Spiral-bound brochure contains a sample of new vinyl-aluminum laminate material. The book also includes chips of each of 39 special Alcoa vinyl color-pattern combinations. Accompanied with technical data and use suggestions, the samples demonstrate the seven "families" of special vinyl designs, in from four to eight colors per design. Aluminum Company of America, 720 Alcoa Bldg., Pittsburgh 19, Pa.

Use postpaid card. Circle No. 63

SPECIALTY FASTENERS

Fifty-six page fastener handbook contains complete data on a wide variety of specialty fasteners; includes sizes, dimensions and installation data. Completely illustrated, the Southco Fastener Handbook No. 11 is an aid to design and product engineers. Southco Division, South Chester Corp., Lester, Pennsylvania.

Use postpaid card. Circle No. 64

CONTRACT RESEARCH

A descriptive statement prepared by Battelle Memorial Institute, now being offered to representatives of industry concerned with research and development, is one of a series on the procedures and characteristics of contract research for industry which is being published by the Columbus, Ohio, research center. The statement describes the balance of administrative controls between the sponsor of a project and the research institute engaged, under contract, to conduct the study. Each of these aspects of administrative control is discussed briefly. Battelle Memorial Institute, 505 King Ave., Columbus 1, O.

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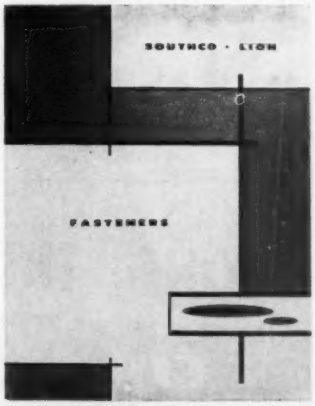
MOLDED PLASTIC KNOBS

Complete line of molded plastic knobs and handles are listed in six-page catalog. Included in the listing are ball knobs, oval and tapered knobs, push-pull and lid knobs, knurled and fluted handwheels, thumb screws and terminal nuts. Each item is photographically shown, along with an engineering drawing giving dimensions, and a brief description of principal use of the knob. Dimco-Gray Company, 207 E. 6th St., Dayton 2, Ohio.

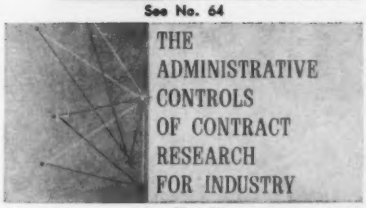
Use postpaid card. Circle No. 66

INSERTS FOR PLASTICS

How an insert is used to form miniature size permanent brass threads in plastics after molding, or in other parent materials, is described in bulletin P-106. A table in the two-page bulletin lists sizes, dimensions, and quantity prices for the insert. Addi-



See No. 64



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brazing washers Edgewound

FROM WIRE STOCK

- No lead time needed for dies or exact strip.
- Use with induction, gas-air, furnace, or other heating methods.
- Available in EASY FLO and SILFOS — Copper, Bronze, and other alloys.
- Diameters up to 4" I.D., wire thicknesses from .010 upward.

No die charges
No blanking scrap losses

Write for 16 page booklet on better brazing.

LUCAS-MILHAUPT Engineering Co.

5060 South Lake Drive, Cudahy, Wisconsin

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LONG, THIN PINS, RIVETS COLD HEADED

FAST... ACCURATELY... MORRIS-OMEGA

Special Model "O" **OPEN DIE** Double Stroke Header, produces long thin parts in diameters from .020" to .090" up to 2⅜" long at rates up to 100 per minute!

Also available: Solid Die Headers for wire diameters as small as .012".

For Complete details and prices, Write:

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tional information covers hole size requirements, installation methods, strength of assembly, and the availability of application assistance. Phelps Manufacturing Div., Heli-Coil Corp., Danbury, Conn.

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QUICK-CONNECT COUPLINGS

Complete engineering and ordering data for the H, IH, E, ES, T and 19 series quick-connect couplings are given in 61-page catalog 60A. Included also are ten pages of charts, showing recommended coupling, packer seal, and temperature limits for fluids and gases. Snap-Tite, Inc., Union City 9, Pa.

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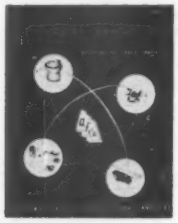

AUTOMATION ACCESSORIES

A brochure, describing newly-developed automation accessories for industry contains detailed information on the company's electric vibrators which are designed to keep hard-to-flow materials, such as small parts, moving freely in hoppers, tracks, bins and chutes. Other applications for Vibra Pak are listed in the 4-page brochure as bulk feeding, parts jogging, screening and packing. Automatic Feeder Co., 4752 W. Washington Blvd., Chicagc 44, Ill.

Use postpaid card. Circle No. 69

DIGITAL SYSTEMS MODULES

Catalog of the 300 Series transistorized digital system modules describes the system functions which are packaged on each gold plated module. Block diagrams, logical design considerations, and input-output specifications are included. Navigation Computer Corp., Valley Forge Industrial Park, Norristown Pa.

Use postpaid card. Circle No. 70

HIGH TEMPERATURE ALLOYS

A booklet on high temperature, high strength alloys, features a series of steels and alloys, each with its own individual leaflet, together with a 28-page general booklet on high temperature alloys. While all the materials are treated in the general booklet, each steel or alloy is treated in detail in the accompanying individual leaflet. Allegheny Ludlum Steel Corp., Oliver Bldg., Pittsburgh 22, Pa.

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COLOR CODING ENAMELS

Color card of coding enamels has actual chips of the 18 popular colors of fast drying, spray type enamels; used for color coding inventory stocks and

work in process; for identifying piping, and electrical connections. Reynolds Ink, Inc., 2075 East 65th St., Cleveland 3, Ohio.

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HIGH SPEED AIR VALVES

Three air valve models capable of filling and exhausting a 100 cubic inch load chamber from 0 to 90 p.s.i. (100 p.s.i. pressure) in 0.150 seconds are illustrated and described in Bulletin 0611-B1. In addition to the valves, a companion line of bottom and side ported bases are described. Hannifin Company, Dept. 416, 501 S. Wolf Rd., Des Plaines, Ill.

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STORAGE RACKS

Use of prefabricated storage rack materials to achieve larger warehousing capacities and greater operating efficiency is described in 16-page booklet, AD409. It explains the prefabricated design of modular rack components. Also described are "drive-in" and "drive-thru" rack components which permit high density, full-access storage of palletized items. Acme Steel Co., Fabricated Materials Div., 135th St. and Perry Ave., Chicago 27, Ill.

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NYLON FASTENERS

Complete description of acetal resin and nylon fastener is given in technical bulletin. Included also are graphs showing creep characteristics, and static tension; technical, procurement and installation data. The Hartwell Corporation 9035 Venice Blvd., Los Angeles 34, California.

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THIN METAL WELDING UNITS

A short-form catalog describes thin metal welding equipment line. It illustrates nine different power supplies and

for immediate delivery

12 POINT EXTERNAL WRENCHING **BOLTS**

certified aircraft quality

Mercury 12 point external wrenching bolts, manufactured from high tensile steel and high temperature, heat resistant materials, to meet exacting customer requirements. High temperature . . . MS 9033 thru MS 9039; High tensile steel . . . MS 9088 thru MS 9152.

Exotic materials available.

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AN—N.A.S.—M.S. and 6-digit hardware.

Immediate delivery of standard sizes

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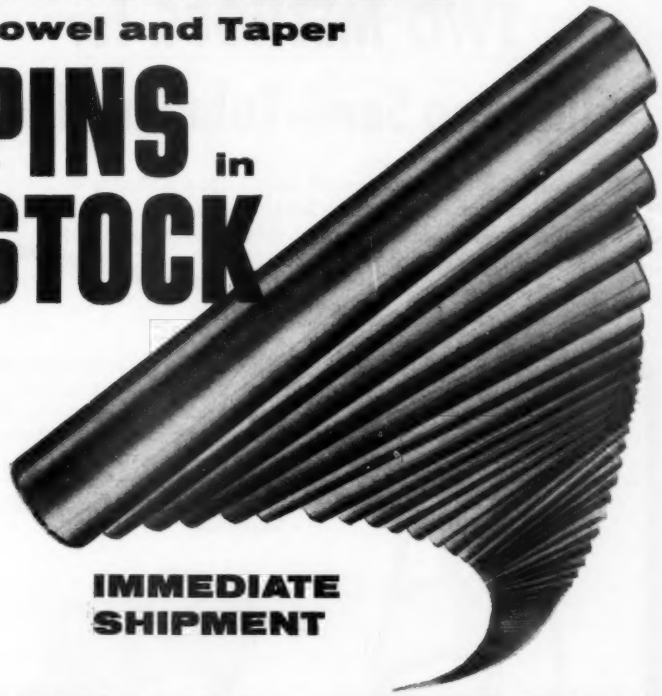

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DOWEL PINS

Precision Tolerance

- Stainless steel 18-8, type 303
- Diams: .0312 through .500
- Lengths: 3/32" through 2½"
- Chamfered ends

TAPER PINS

Commercial, Precision and AN

- Stainless steel 18-8, type 303 Also many in type 316 (Commercial tolerance)
- Size: 9/0 through 10 in stock
- Lengths: 3/16" through 8" (Not all lengths in all sizes)

- "Specials" manufactured promptly. Large variety of raw material, on hand, for fast service.

PLUS all types and sizes of screws (slotted, Phillips—both magnetic and non-magnetic—hex, socket), bolts, nuts, washers, rivets, nails, keys, etc.

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Manufacturers of stainless steel fasteners since 1929

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Midwest Division 6424 West Belmont Avenue, Chicago 34, Illinois
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West Coast Division—Warehouse & Office
5822 West Washington Boulevard, Culver City, California
Phone: WEbster 3-9595 TWX: LA 1472

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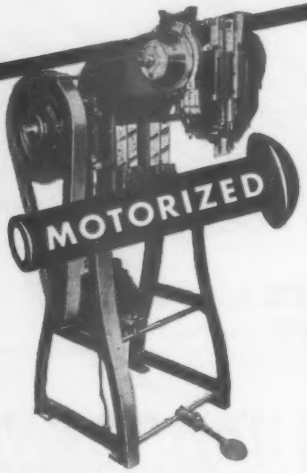
Why *Chicago Rivet* Offers TWO METHODS for Clinching Semi-Tubular Rivets

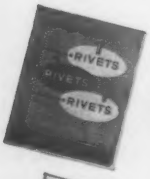
It is part of a widening service based upon industry's recognition that an assembly held together by semi-tubular rivets has great inherent strength and is usually lowest in production cost.



The Chicago Rivet MOTORIZED AUTOMATIC RIVET SETTER produces a sharp, solid blow that immediately upsets the tubular section. This method is used on 95% of all applications involving metals or non-fragile materials.

The Chicago Rivet AIRPOWERED RIVETER produces a cushioned, shock-free clinch on a tubular rivet, permitting riveting of fragile and uneven materials. This method has greatly widened the use of semi-tubular rivets.

FOR YOUR FILES



RIVET CATALOG describes 1388 standard tubular and split rivets and 25 single and multiple motorized automatic rivet setters.

AIR-POWERED RIVETING catalog contains description and specifications of 8 single and multiple riveters—also rivet setters designed for automated operation.

Why not let Chicago Rivet Fastening Engineers tell you which system is best for you. No obligation.

MOTORIZED

Line includes automatic single, multiple and automated setters.

AIR-POWERED

Line includes automatic single, multiple and automated setters.

Chicago Rivet
& MACHINE CO.
946 So. 25th Ave., Bellwood, Ill.
(Chicago Suburb) Branch Factory:
Tyrone, Pa.

Use postpaid card. Circle No. 256

eight different weld heads and handpieces. The power supplies range from a 5 KVA half cycle AC unit through a 500 watt-second stored energy unit. Specifications are shown for all units. Vacuum Tube Products Div., Hughes Aircraft Co., 2020 Short St., Oceanside, California.

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ELECTRIC TERMINALS

Complete line of terminals and connectors are cataloged in 44-page bulletin, 822. Each item is listed by size, dimension, and catalog number. Included also is a list of hand and production tools for installing the terminals and connectors. Thomas & Betts Co., Inc., 2838 Butler, Elizabeth, N. J.

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RHENIUM ALLOYS

An illustrated brochure on the fabrication, applications, price and varieties of rhenium and rhenium alloys contains detailed information and charts on relative advantages and properties of the material. Chase Brass & Copper Co., Waterbury, Conn.

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NUMERICAL CONTROL

Data about the growing machine tool-numerical control field is presented in 32-page booklet. It defines the meaning of numerical control and explains the use of punched tape in machine tool applications. Other subjects covered include: where numerical control is used, programming tapes, standardizing punched tapes, and standardized programming. Freiden, Inc., 97 Humboldt St., Rochester 2, N. Y.

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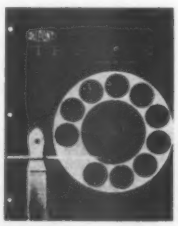

FLUOROCARBON RESINS

The use of the fluorocarbon resin, Teflon, for seals and rings, bearings, hose, electrical components; gaskets and packings is described in eight-page information bulletin. Included also is a table of properties. Polychemicals Dept., E. I. duPont deNemours & Co., Inc., Wilmington 98, Del.

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EDITORIAL ITEMS

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SOLDERING CATALOG

A total of 80 models in seven distinct types of soldering irons, from 20 to 700 watts; ⅛" to 1¾" tips are listed in catalog No. 111. Included are the following; long-life tips, instant solder guns, 3 wire cord and plug assemblies, super-pencil, pin-point and battery type irons. Hexacon Electric Co., 635 W. Clay Ave., Roselle Park, N.J.

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HOT MELT ADHESIVE

A series of bulletins, provides complete information and technical performance data for each of the seven most recently developed formulations of hot melt adhesive. Listed in each bulletin are the materials which can be bonded with each of the formulations. Thermogrip, United States Shoe Machinery Corp., B.B. Chemical Div., 784 Memorial Dr., Cambridge 39, Mass.

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HIGH PRESSURE SEALS

Complete information on the company's entire line of explosion and high-pressure seals for switches and shafts; high-pressure self-sealing fasteners; transparent and flexible switch seals; Power Connectors with auto-deflecting grounding blades; and other company products is given in 16-page catalog 359B. Included for the first time are fasteners with nylok. A.P.M. Corp., 41 Honeck St., Englewood, N. J.

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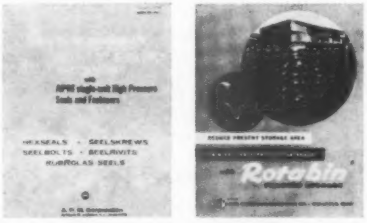

ROTATING STOCK BINS

How rotary storage bins for stock items can reduce storage area, without reducing storage capacity is described in 14-page booklet. Included also is a catalog description of stocks bins accessory parts. The Frick-Gallagher Mfg. Co., Wellston, Ohio.

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CABINET DESIGN

An illustrated brochure describes in detail company's complete facilities for the design and fabrication of metal boxes, cabinets and merchandising displays. Also included is an explanation of the planning, design, model fabrication and engineering services provided. Durham Mfg. Company, 110 Main St., Durham, Conn.

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Answer to problem on page 52. He didn't end up with two equal squares; their sides are 31" and 49".

for vital cost reductions in assembly and machining

specify-**Standard Cam-Operated Indexing Units**

Standard, Index Units . . . Rotary and Straight-line . . . are designed to be used in machines to provide automatic index motion to fixtured dials and direct mechanical motion to insertion stations, escapements and probes.

Fast, smooth, shock-free indexing is assured by the use of cycloidal cams—with extreme accuracy and at production rates to 6000 per hour.

Standard Model ST-A9AB Precision Rotary Index Unit. For light to medium duty. 4 to 20 stations. Accuracy to ±.0005" at 6" radius. Production rate to 6000 per hour.

Standard Model St.-A9B. Heavy duty Rotary. 8 to 24 stations. Accuracy to ±.001" at 7" radius. Production rates to 6000 per hour.

Standard Model St-A18 . . . Heavy duty transfer type, straight line unit 27 to 51 work carriers accuracy to ±.003" production rates 6000 per hour.

Write for complete engineering bulletin, 26-F on Standard Cam-Operated Indexing Units.

MACHINERY DIVISION

Standard Tool & Manufacturing Co.

738 SCHUYLER AVENUE • LYNDHURST, NEW JERSEY

Better Products at Lower Cost Through Better Methods

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Planetary Thread Rolling Machine

Rolls Screws, Bolts and Nails

400 TO 800 PIECES PER MINUTE

CAN CUT COSTS 65%
IMPROVES QUALITY
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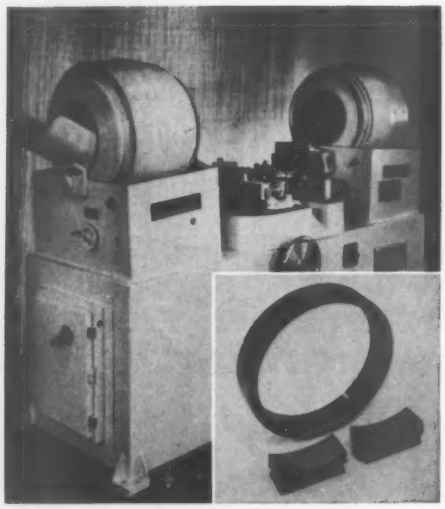


Prutton Planetary Thread Rolling Machine
Model 125A-24

When you stop lost motion you start cutting costs. That is the basic idea behind Prutton's Planetary die system. This Model 125A-24 Prutton Thread Roller produces 400 to 800 threaded parts per minute—class 3 fit. It easily handles thread rolling; roll forming; knurling; serrating and necking. It rolls diameters .090 to 5/16" and can apply threads up to 3 inches long. Special models handle blanks up to 8 inches long.

Die life of five million pieces is not unusual because the Prutton Planetary Die has 36 inches of working surface. Conventional machines would require a five foot stroke to handle equivalent die area. But, the Prutton Planetary Die measures only 12 inches across and the entire machine occupies a mere 18 square feet of floor space. One Prutton can replace four or more conventional machines.

Write or Phone for Cost Saving Information, TODAY!

PRUTTON
PLANETARY THREAD ROLLERS

PRUTTON CORPORATION
Leader in Planetary Thread Rolling Machines

5305 WEST 130th STREET CLEVELAND 30, OHIO

Use postpaid card. Circle No. 258

CAM INDEXED ROLL FEEDS

Cam indexed roll feeds for precision feeding of dynamically controlled roll and strip stock at rates exceeding 3,000 inches a minute are described in catalog No. 500. Data includes graphs for determining operating speeds and formulas for analyzing machine dynamics, selecting the proper acceleration characteristics and determining correct roll pressures. Ferguson Machine Co., 7818 Maplewood Industrial Court, St. Louis 17, Missouri.

Use postpaid card. Circle No. 85

SPRING PIN MANUAL

Complete data on Sel-Lok Spring Pins, including design and performance information not previously published, is contained in an eight-page product bulletin, 2670. The literature illustrates and describes 16 different applications, and suggests many more uses, for the self-locking fastener. Standard Pressed Steel Co., Box 1121, Jenkintown, Pa.

Use postpaid card. Circle No. 86

ELECTRON BEAM WELDING

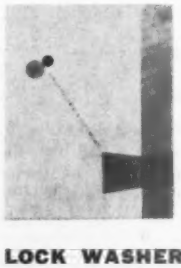
Brief description of electron beam welding, its development and photographs of company's electron beam welding facility are given in six-page brochure. Sciaky Bros., Inc., 4915 W. 67th St., Chicago 38, Ill.

Use postpaid card. Circle No. 87

SOLID LUBRICANTS

Series of bulletins describe properties, surface preparation, applications, curing and storage of resin bonded solid lubricants. Included also is price list and specifications for company's No. 75 and No. 42 lubricants. Poly Chem, Inc., 541 S. Webster Ave., Indianapolis, Ind.

Use postpaid card. Circle No. 88



LOCK WASHERS

Bulletin explains how helical spring lock washers compensate for the real causes of looseness in bolted assemblies. Written in simple language, and illustrated with simple line drawings, it explains how helical spring lock washers work, how they maintain bolt tension to overcome the basic causes of

looseness which are also explained in understandable terms. The Mellowes Co., 125-P E. Nash St., Milwaukee 12, Wisconsin.

Use postpaid card. Circle No. 89

PARTS FEEDERS

Illustrated brochure shows typical installations, presents details of construction and points out the advantages of parts feeders for high volume production through automation. It shows the different features available and presents a diagram of maximum dimensions and specifications of each unit. Elk Engineering Works, St. Marys, Pa.

Use postpaid card. Circle No. 90

CLAMPS, COUPLINGS & JOINTS

Brochures covering clamps, couplings and joints for both maintenance and original equipment provide detailed information on sizes and are illustrated with photographs and dimensional diagrams. These brochures cover complete information on pipe joints which do not require threading or grooving, an improved hose clamp, band clamps, pipe repair clamps, identification clamps and threaded union joints for small diameter tubing. Marman Div., Aeroquip Corp., 11214 Exposition Blvd., Los Angeles 64, Calif.

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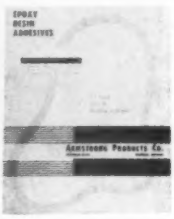

EPOXY RESIN ADHESIVES

Engineering information and prices for the "C-series" epoxy resins are given in 16-page catalog. Included also are prices and technical information on company's group of epoxy activators. Armstrong Products Co., Argonne Rd., Warsaw, Ind.

Use postpaid card. Circle No. 92

LIGHTING CATALOG

Lamp catalog describes and illustrates line of incandescent, fluorescent, combination and magnifying lamps. The adjsutable lamps are ideal for use over assembly and inspection benches, machinery, drafting tables, office equipment and in laboratories. Luxo Lamp Corp., Dock St., Port Chester, N. Y.

Use postpaid card. Circle No. 93

CONVEYOR MUFFLE FURNACE

Bulletin describes the advantages and features of conveyor muffle furnace for continuous bright copper brazing, bright annealing and bright hardening of stainless steel. Included also is chart giving specifications and sizes. Sunbeam Equipment Corp., Meadville, Pa.

Use postpaid card. Circle No. 94

Fastening the V-shaped braces to these table legs was giving the manufacturer trouble. Sheet metal screws loosened under daily use, gave an unfair impression of the product.

Now Detroit Breakfast Furniture Company, Detroit, Michigan, installs RIVNUTS into the legs, fastens the braces with screws inserted in the RIVNUTS. The fastening is shakeproof, strong, and contributes to a clean design and appearance.

RIVNUTS are the original one-piece blind rivets with internal threads. To see if they can help on *your* fastening problems please send a print of your part. For bulletin, see *Sweet's Product Design File*, or write Dept. AE-9, *B.F.Goodrich Aerospace and Defense Products, a division of The B.F.Goodrich Company, Akron, Ohio. In Canada: Kitchener, Ontario.*

B.F.Goodrich Rivnuts

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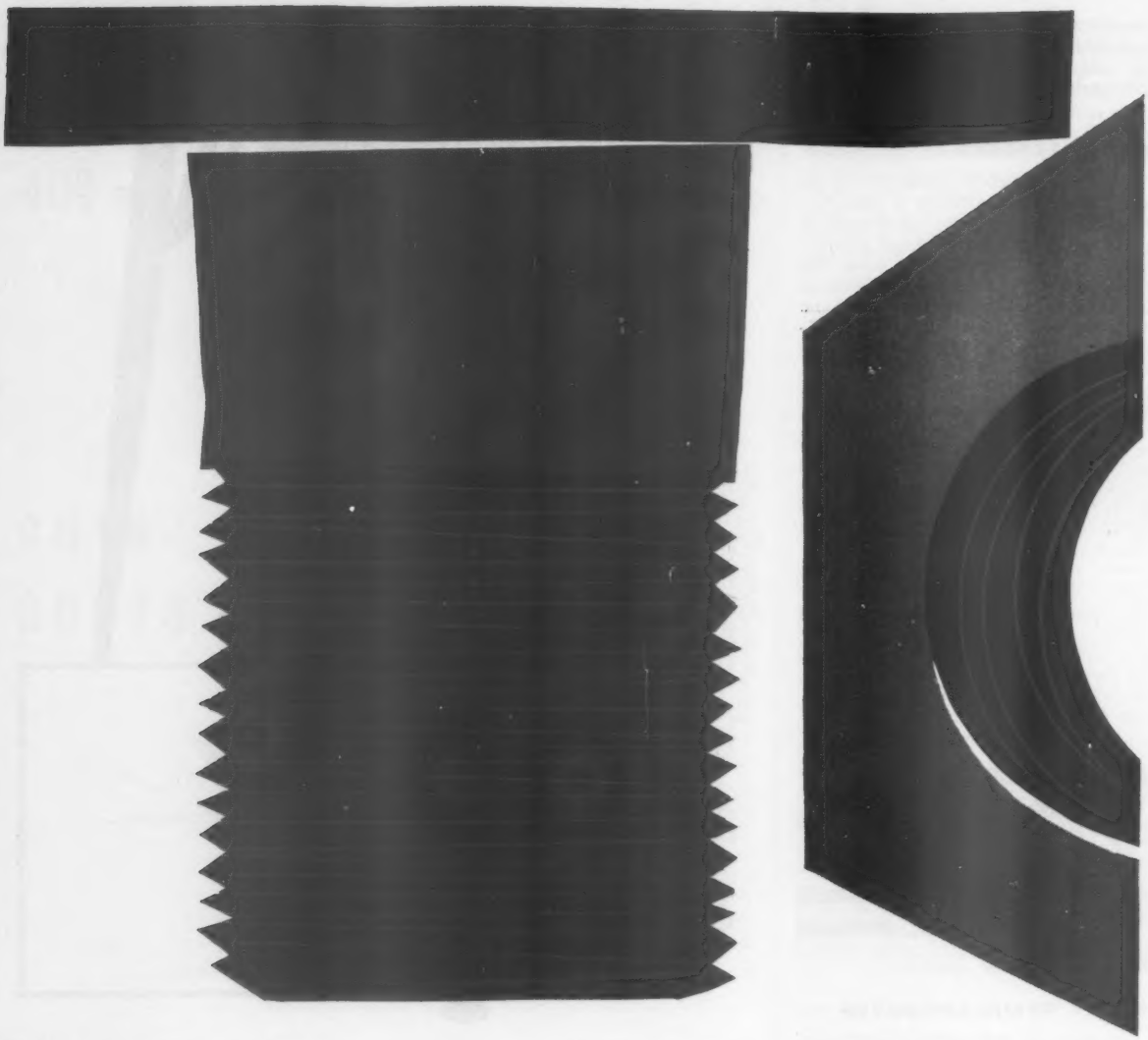


imagineering is the bold new look at Screw & Bolt that says "infinite design capability." Imagination, coupled with engineering, has led to endless new product design developments in fasteners and other threaded parts. ■ Need a new design fastener or threaded part where standard shelf items just won't fit? Clip this ad to your letterhead and Screw & Bolt's sales engineers will put *imagineering* to work for you.

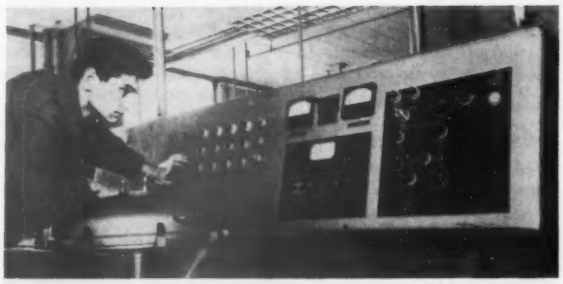
VMA 9387

SCREW AND BOLT CORPORATION
OF AMERICA • P.O. BOX 1788, PITTSBURGH 30, PA.
Plants: Pittsburgh, Pa. Gary, Ind. Southington, Conn. Norristown, Pa. • Warehouses: Portland, Ore. Denver, Colo. Atlanta, Ga.

Imagineering... for greater fastener progress

Use postpaid card. Circle No. 206

INDUSTRY MAKES NEWS



Operator is adjusting the power input for the vacuum furnace where rhenium-tungsten is sintered at temperatures up to 2500° C and at pressures of approximately .02 microns. The addition of tungsten-25 rhenium alloy to pure rhenium and molybdenum-rhenium alloys makes possible higher temperature capabilities for measuring devices and more reliable components for electronic equipment.

New ordnance facility where development and design of specialized mechanical-ordnance separation systems and devices for aircraft, missiles and space vehicles will be carried on.

CHASE BRASS PRODUCES NEW METAL ALLOY

Commercial production of rhenium-tungsten alloy strip has been announced by Chase Brass & Copper Co., a subsidiary of Kennecott Copper Corp.

The alloy development makes possible a whole new range of high temperature measurements in the electronics aero-space, missile and nuclear fields. Also, it makes possible much more reliable electronic components for radar, missiles and aero-space craft.

High temperature measurements have become increasingly important in the development and testing of space vehicles and nuclear-fueled facilities. Rhenium-tungsten alloys provide the suitable materials for use in thermocouples to measure extremely high temperatures.

Tungsten has an operating temperature range up to about 3000°F when used in thermocouples, the new alloy has a range up to 5400°F. Tungsten also becomes glass-brittle at room temperature in the recrystallized condition and can shatter from mechanical vibration or thermal shock. The alloy, W-25 Re does not become brittle upon recrystallization.

The electrical resistivity of the alloy is somewhat higher than tungsten, permitting heavier, more rugged filaments or heaters.

At present, the alloys are produced by powder metallurgy techniques.

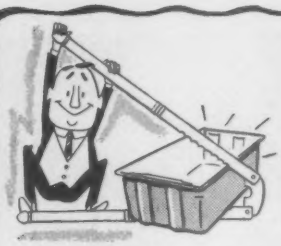
JUNE FASTENER SHIPMENTS

June, 1961 shipments of fasteners were 90% of the 1956-58 average, according to the Industrial Fastener Institute.

The June shipments were 4% over May of this year, and marks the second straight month of improvement in the shipments. It is also the highest fastener shipments have been since September, 1960.

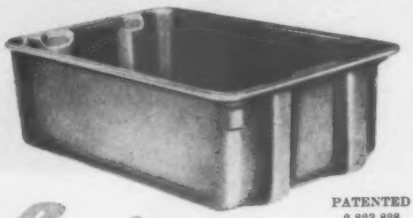
HI-SHEAR OPENS ORDNANCE FACILITY

With the completion of its new ordnance facility, the Hi-Shear Corporation has expanded its development and manufacture of ordnance items. The new unit will include design, development and manufacture of power cartridges, separation nuts, pin pullers, ten-



WON'T SHATTER
WON'T ROT
WON'T DENT
WON'T RUST
WON'T WARP

Stack-u-Nest® Tote Pans



PATENTED
2,823,828
2,823,829

Lewis FIBER GLASS
reinforced polyester

SIZES	COLORS
16x10x5	RED
18x12x6	
18x12x8	
22x14x5	GREEN
22x14x8	
22x17x10	GREY
27x16x11	
30x19x14	
34x24x19	

They stack and nest in their own dimension

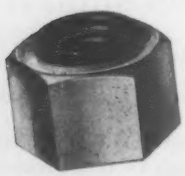
No mechanical gadgets or space wasting cross-stacking. These pans stack straight, firm, and high . . . possible only with the exclusive Lewis "contour offset" design. Heat pressure molded in one piece of mighty Fiber Glass.

G. B. LEWIS COMPANY • 209 Montgomery Street • Watertown, Wis.

Use postpaid card. Circle No. 263

Spring Steel

makes the difference in LOCKNUTS!



- The Security Locking insert is the finest Heat Treated Spring Steel. It brings the dependability of your watch spring.
- Its elliptical shape locks on a properly threaded bolt with a grip that can't shake loose yet gives the flexibility of any number of removals and replacements.

SECURITY LOCKNUT CORPORATION
1800 North 15th Avenue, Melrose Park, Illinois

Security

THE NUT YOU CAN'T SHAKE LOOSE

Use postpaid card. Circle No. 264

sion rod and cable disconnects, detonators, delay systems, gas generators and a family of gas-actuated mechanical systems to operate valves, pumps, switches and to release or jettison instrumentation and equipment from weapons systems and airborne vehicles.

THREE PROMOTED AT CLECO AIR TOOLS

WRIGHT

HOZA

LUTHY

R. R. Wright, former chief engineer for Cleco Air Tools Division of Reed Roller Bit Co., has been named vice president of the air tool division. He joined the parent company in 1939, and has been with the Cleco division since 1948.

Martin Hoza has been appointed chief engineer of the division. Prior to his present appointment he served as head of the division's research and development engineering department. He joined the company in 1954.

Larry E. Luthy has been named to the position of manager of market development. In his new post, he will direct market research and analysis for the air tool division as well as advertising and product promotional activities.

HYSOL ACQUIRES PERMACEL LINE

Permacel's epoxy electrical insulation potting and encapsulation product line has been sold to the Hysol Corp. Hysol will manufacture and market these materials and

MULTIPLE SPINDLE SCREWDRIVING MACHINES
A complete line of equipment for high production.
Feed and drive screws in Multiples up to 10 screws at a time.

SINGLE SPINDLE SCREWDRIVING MACHINES
For assemblies that require the driving of one screw at a time.

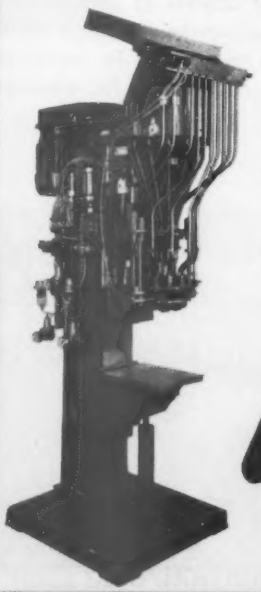
NUT SETTING MACHINES
Mechanize Nut driving operations.

INSERTING EQUIPMENT
Feed and insert pins, rivets, etc. singly or in multiples.

PART FEEDERS
A complete line of feeding equipment.
Various types and sizes to suit job requirements.

COMPONENTS
All above machines can be furnished adapted for incorporation into Automatic Assembly Machinery.

ASSEMBLY EQUIPMENT
Economical machines designed and built around standard Cook & Chick components to meet job requirements.



COOK & CHICK COMPANY
2415 West 24th Street Chicago 8, Illinois

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will service the former Permacel customers. Both companies will continue to produce and market their other traditional product lines.

ROTOR TOOL NAMES SALES ENGINEER

BURTON

Rotor Tool Company, Cleveland, has announced the appointment of two sales engineers to service their customers in Ohio.

Harold Burton will represent the firm in their northwestern Ohio territory. Prior to joining Rotor, he was the factory dealer representative for the Billings & Spencer Co.

James Davis will be the company's representative in the Youngstown area. Prior to joining Rotor, he was sales engineer for the Radio Parts Co. Pittsburgh, Pa.

Rotor Tool Co., is a subsidiary of the Cooper-Bessemer Corp., Mt. Vernon, Ohio.

FAIRBAIRN PROMOTED AT H. M. HARPER CO.

James Fairbairn has been named director of purchases for The H. M. Harper Company, Morton Grove, Illinois.

Fairbairn, whose previous title was purchasing agent, joined the company in 1935. He is a member of the Board of Governors, Purchasing Agents Association of Chicago.

ULTRASONIC WELDING SYMPOSIUM

The Air Force Systems Command, Space Systems Division, recently sponsored an ultrasonic welding presentation at its Inglewood, California, headquarters. The purpose of the meeting was to introduce ultrasonic welding to ballistic missile and space system contractors. The Air Force invitation commented that ultrasonic welding was becoming "a

CLOSURES

To Protect Threads, Tubes, Valves, Components, etc. from Dirt and Mishandling
Available from Stock

ALUMINUM

Pipe Caps

"C" Series AN & SAE Fittings.

Pipe Plugs

"P" Series AN & SAE Fittings

"D. O. C." Series Drive-on Caps

"C-FT" Series to all Thread Specifications

"D.I.P." Series Drive-in Plugs

"ERA" Series for ERMETO and MS Fittings

POLYETHYLENE

"200" Series Tapered Plug & Cap

"LT" Series Tube Caps

"TY" Series Thick Wide Flange Tapered Plug & Cap

"600" Series Single Thread Pipe Caps

"EP" and "EE" Series Elec. Conn. Plugs & Caps

"TC" Series Self-Sealing Caps—for AN & SAE Fittings

"IF" Series Plugs for Inverted Flare Fittings

"SP" Series Flange Caps

Special Closures Manufactured to Customers' Specifications, of Aluminum or Polyethylene. Quotations on request, furnish description desired including thread size.

Manufacturers of Industrial Closures Since 1944

CLOVER INDUSTRIES, INC. 564 Young Street Tonawanda, N. Y.

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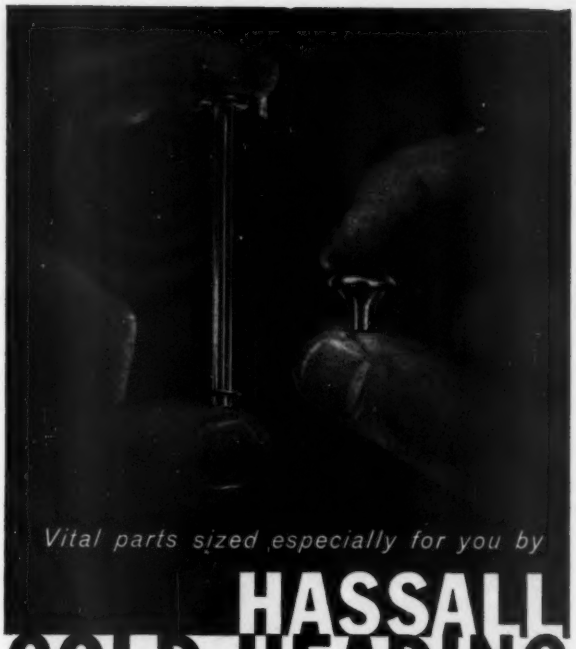

VITAL FASTENERS—rivets, nails, screws, pins; threaded, shouldered, drilled, close tolerance, AN specs, special alloys.

The fastener itself is often a minor part of your assembly cost. If a Hassall Job-Designed rivet can reduce assembly time, meet re-design demands quickly and make joining simpler, lower costs will result.

VITAL METAL PARTS—shafts, axles, studs, spacers, stops, hinges, clutch rollers and thousands of vital component items. All available from the limitless possibilities of cold forming, the technique that moves, rather than removes, valuable metal; no chips, no waste.

Our catalog illustrates the variety of shapes and sizes available when the need arises for vital fasteners and parts.

We offer design and material selection help. Send sketch and/or samples. Write for latest catalog.

JOHN HASSALL, INC.
Cantiague Road
Westbury, Long Island, N.Y.

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GRIPCO TOPLOCK NUT
One piece all metal

GRIPCO CLINCH NUT
With or without self-locking threads. Hex collar prevents turning when torqueing bolt.

GRIPCO PILOT-PROJECTION WELD NUT
With or without self-locking threads. Centering collar positions nut and protects threads from weld spatter.

You get these "extras" when you specify

GRIPCO®

FASTENERS—

Service **—40 sales representatives all over the country for prompt, fast service.**

Reliability **—Quality controlled by the oldest established lock nut manufacturer in the U.S.**

Stock **—Large inventories to ensure out of stock delivery on all catalogued items.**

Speed production and lower costs on your products with this GRIP NUT family of GRIPCO FASTENERS. Qualified fastener engineers are available for consultation on all your assembly problems. Consult the yellow pages in your phone book under "GRIPCO" for the one nearest you.

Other Gripco Products:

- **Brass Toplock or Centerlock nuts.**
- **Miniature weld and clinch nuts, with or without lock.**
- **Toplock and Centerlock Hi Nuts.**
- **Standard Semi-finish full and jam nuts.**
- **Stainless Steel lock, weld and semi-finish nuts.**
- **Cold formed special nuts or parts to print.**

Send for samples and NEW CATALOG today

GRIPCO CENTERLOCK NUT
Locking feature in the center for fast feeding. Can be applied from either end.

GRIPCO COUNTERSUNK WELD NUT
With or without self-locking threads. Countersink protects threads from weld spatter.

GRIP-NUT COMPANY 125

113 MAPLE AVE.
SOUTH WHITLEY, INDIANA
Phone: South Whitley 723-5111

Subsidiary of Heli-Coil Corporation, Danbury, Conn.

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vital metal joining technique" . . . "permitting designs which were previously considered nonproducible."

R. S. Ames and J. M. Peterson of Aeroprojects-Sonobond participated in the meeting and gave an unclassified presentation which covered the general principals of ultrasonic welding, and touched on a number of successful applications.

RB&W SETS UP SINTERED PRODUCTS DIV.

A Sintered Products Division for the manufacture of powder metal parts has been established by Russell, Burdsall & Ward Bolt and Nut Company.

Typical parts to be produced from powder metals by RB&W include standard nuts, special nuts and shapes with tapped holes, sleeves, spacers, inserts, discs, gears, rollers, electrical connectors, mechanisms and bushings.

The new division is sintering parts from brass, bronze, copper, Monel and nickel silver among non-ferrous metals, as well as iron, steel and stainless steel.

MOON TO RECEIVE ASME HOLLEY MEDAL

Thomas E. Moon, an engineer stricken with blindness at the age of 56 will receive the 1961 Holley Medal of the American Society of Mechanical Engineers.

The Holley Medal is awarded for "an act of genius" that accomplished "a great and timely public benefit."

Since Moon became blind in 1945, he devoted himself to developing devices on behalf of the blind. His major contribution, known as the Moon Mechanical Trephine for Corneal Transplants, gives eye surgeons better control and precision in making incisions than is possible in "free hand" surgery.

This precision, in turn, provides greater safety and a better chance of a successful operation.

Formal presentation of the medal will be made in November at the winter annual meeting of the ASME.

HIGH SPEED equipment for better production, lower cost

RIVETING HAMMERS

Available in 10 sizes. Handle full range of work up to 2" diameter solid rivets. Quick to set up or change tools. Available in bench and pedestal models. Backed by finest, most complete tooling service in the industry.

NOISELESS RIVET SPINNERS

Motor-driven, noiseless, rugged. Spindle travel adjustable. Fast cycle. Produces absolutely uniform assemblies. Model E (capacity 1/8") and Model G (capacity 5/16") available in both bench and pedestal models, foot or AIR operated.

ELECTRIC SOLENOID PUNCH

Stakes, rivets, marks, cuts off, bends, crimps, etc. with positive alignment. 4½" maximum vertical opening (2¾" minimum for tools and work). 1¾" spindle travel, adjustable downward. Fast cycle. 3500-lb. impact. Single or dual, hand or foot control.

AUTOMATIC STAKING MACHINES

Pressure pad built into spindle firmly secures work before blow. Allows for variation in thickness. Delivers uniform blow every time. Quick, easy adjustment, wide power range. 4 sizes—bench and pedestal models, foot and air operated.

We manufacture the most COMPLETE LINE of assembly machinery on the market today, so generally can recommend the CORRECT TYPE MACHINE for any assembly application.

FREE Assembly Engineering Service

Just send samples or blueprints of parts to be assembled. We'll recommend the right tools, procedure and equipment to use . . . without cost or obligation.

HIGH SPEED HAMMER CO.

308 NORTON ST., ROCHESTER 21, N.Y.

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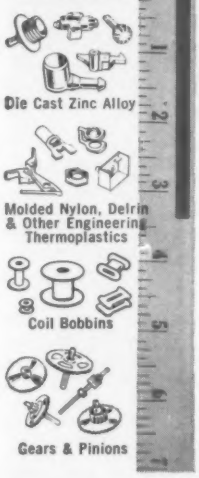
GRC tiny parts

Die Cast
ZINC ALLOY
Molded
PLASTICS



"SMALL ZINC ALLOY DIE CASTINGS"

Fact-filled booklet contains helpful designer's check list, exclusive GRC methods to help you create new products at substantial savings.

GRC's unique high speed, automated methods give you high quality, uniformly accurate small parts in die cast zinc alloy or molded Delrin, Nylon and other engineering thermo-plastics . . . at low cost. GRC experience and exclusive techniques open the way to new design freedom, new production and assembly shortcuts. Write, wire, phone NOW for samples and detailed bulletins. Send prints for prompt quotation.

NO MINIMUM SIZE!
Maximum sizes: Zinc Alloy—2" long, ½ oz. Plastic—1¾" long—.05 oz.

GRIES

GRIES REPRODUCER CORP.
World's Foremost Producers of Small Die Castings
15 Second St., New Rochelle, New York • NEw Rochelle 3-8600

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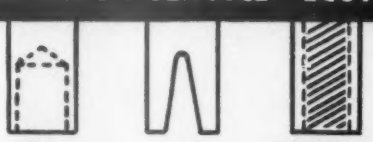
SHELTON RIVETS

QUALITY • SERVICE • ECONOMY

Famous Since 1836



TUBULAR **SPLIT** **INTERNALLY THREADED**

Shelton has effectively demonstrated its techniques and practical solutions to creative problems in rivets of all types. A sense of personal responsibility and quality control is the prime asset of this company. It is our desire to serve, secure and retain customers, whether they use 25,000 or 25,000,000 rivets, through an attitude of helpful service. We will consider it a privilege to be invited to discuss your needs.

THE SHELTON TUBULAR RIVET CO., Shelton, Conn.

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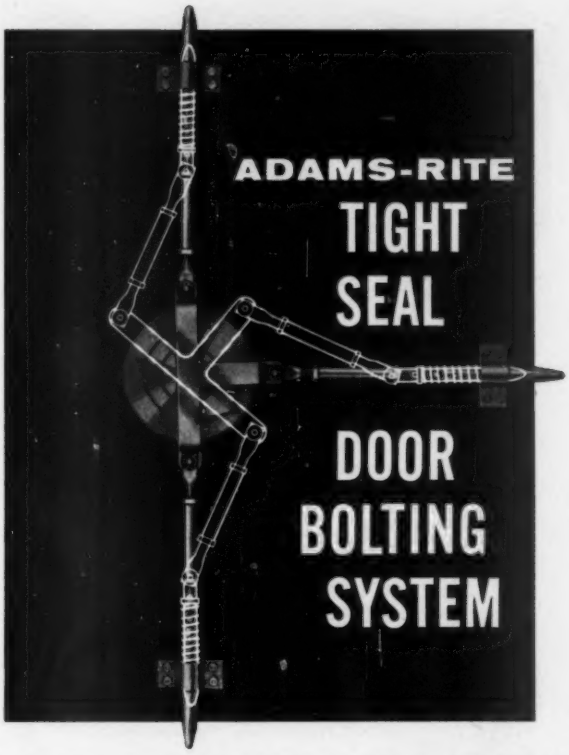

FOR POSITIVE CLOSURE

ADAMS RITE multiple-bolt systems are designed for use on doors and panels which must be secured at more than one point. They are of particular value on doors or hatches which must be closed with a POSITIVE seal to prevent the entrance or escape of moisture, air or gas. Environmental chambers, electronic equipment, pressurized testing units, and paint spray booths are a few of the applications where these A-R systems have proven themselves.

ADAMS RITE has been manufacturing precision mechanical products for over 50 years and is the major supplier of door hardware for the aircraft industry. A-R products are Designed for a Purpose and include locks, latches, handles, door bolting systems, tie-down fittings, and mechanical controls. Products for specialized applications are designed and manufactured to customer specifications.

AVAILABLE WITH:

FLUSH HANDLE

LOCKING HANDLE

NON-LOCKING HANDLE

Write for complete information or latest file catalog of descriptive literature. Dept. B-2

a r

"Over half a century"

ADAMS RITE
MANUFACTURING COMPANY
540 West Chevy Chase Drive
Glendale 4, California

Use postpaid card. Circle No. 272

Pyles AIR-OPERATED SEALANT GUNS

reduce material waste up to 75%

Save TIME, MATERIAL and MAN HOURS with PYLES high efficiency equipment.

- Quality built for long service.
- Ideal for two-part compounds.
- Sturdy, all-metal construction.
- Disposable polyethylene liners save cleaning.
- Smooth, uniform flow. Dripless shut-off.
- Lightweight, easy handling.
- Uses standard air supply.

Write for detailed literature and prices.

Pyles

PYLES INDUSTRIES, INC.

20855 TELEGRAPH RD. · DETROIT 41, MICH.

Use postpaid card. Circle No. 273

Nothing SEALS as POSITIVE!

NYLTITE®

ROLLED NYLON WASHERS

make a positive seal up to 250°F and can be used with any standard fastener including tapping screws

NYLTITE WASHERS SEAL AND STOP LEAKS WITHSTAND PRESSURE UP TO 15,000 PSI RESIST VIBRATION • PREVENT CRAZING RETARD ELECTROLYSIS AND ARE EXCELLENT FOR INSULATING

(Long, headed sleeves are also available from stock)

SEND FOR SAMPLES AND LITERATURE NOW!

NYLTITE CORPORATION OF AMERICA

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NEW AD. MGR. FOR SHAKEPROOF

Ray R. Raufeisen has been named advertising manager for the Shakeproof Division, Illinois Tool Works, Elgin. He succeeds James R. Dougherty, who has been transferred into sales activity for the division.

Raufeisen was associated with the Edelstein-Nelson Advertising Agency, Chicago, for the past four years.

BENERSON DIV. TO DESIGN ASSEMBLY EQUIP.

The Benematic division of Benerson Corp., Evansville, Ind. has been formed to continue the firm's work in the design, development and production of automated assembly equipment.

The division offers staff and facilities for project analysis, cost estimating, project engineering and product design, development and manufacture, including testing, inspection and de-bugging.

NEW REPRESENTATIVES FOR PARKER SEAL

The Parker Seal Co., division of Parker-Hannifin Corp., announced the appointments of the following representatives:

John P. Gregor, representative in southern Texas, Louisiana, Arkansas, Mississippi and western Tennessee.

Earl Hobein, representative in the San Diego, Calif., and Arizona area.

Alfred Finch, representative in Washington and Oregon.

Pierce R. Tower, representative in northeast Los Angeles, San Gabriel Valley, San Bernardino and Riverside Counties, California.

PHEOLL BUYS SCOVILL FASTENER LINE

Pheoll Manufacturing Co., Inc., Chicago, has purchased the industrial fastener line of Scovill Manufacturing Co. located in Waterbury, Conn.

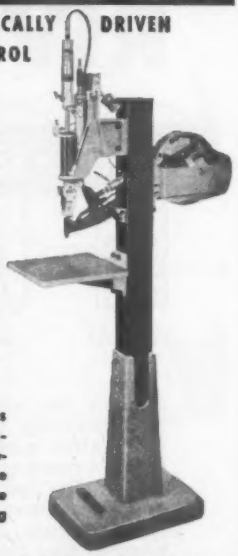
This operation will now become integrated with Pheoll's

NEW DIXON AUTO-TORQUE Driver

SCREWS AND NUTS AUTOMATICALLY DRIVEN WITH PRECISE TORQUE CONTROL

Gives you . . .

1. Complete control of screws from parts feeder to chuck, until threads are started. No dependence on gravity to load chuck.
2. Exclusive built-in sensing, assures that screw is driven. Automatically retracts driver only after attaining proper torque.
3. Complete automatic cycle, requires only a touch of the pedal.
4. Torque accuracy within 5%, comparable to most precise hand-torquing methods.
5. Clutch free-wheels after driving. Operator cannot vary the torque.
6. Two ranges of torque available 0 to 84 inch-pounds and 48 to 120.
7. Work height adjustment with 14" range, can be made without in any way disturbing the machine adjustments.



The new DIXON *Auto-Torque Driver* includes all the features of the DIXON Auto-Positioner, and has an efficient space-saving air motor with an adjustable-torque clutch. These features provide for positive handling, giving new efficiency in driving screws and nuts.

Full information available in bulletin No. SD-8T.

Model SD-100, above, tooled for any standard screw up to ¼" thread size. Special tooled units with multiple feeders available. Model SD-101, without floor column, provides a complete automatic station. Maximum width 6 inches.

DIXON AUTOMATIC TOOL, INC.

2309 - 23rd AVENUE

ROCKFORD, ILLINOIS

DIXON

EQUIPMENT FOR AUTOMATIC PARTS HANDLING AND ASSEMBLY

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THAT STRETCHES AND RECOILS JUST LIKE A TELEPHONE CORD!

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NYCOIL—the original recoiling air hose made of tough, permanently coiled nylon tubing. It offers more resistance to abrasion and corrosive materials and because of its bright, red color and self-storing ability, NYCOIL contributes to higher safety, better production and good housekeeping. Its smooth inside surface permits better air flow. Easily connected to tools and equipment requiring air pressure up to 200 psi.

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FOR ALL TYPES OF FASTENERS

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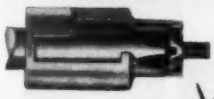

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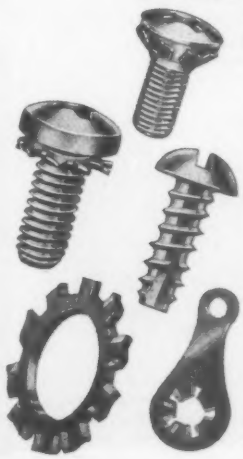

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We are one of the few fully integrated manufacturers of Sems, lock washers, thread-cutting screws, terminals and cold-headed specialties. Since our engineering services and components manufacturing are together under one roof, we are particularly well able to give you fast, individualized service at competitive prices. We'll bid on your specials requirements, or fill orders for standard items on short notice from the extensive line of EVERLOCK products stocked by your local distributor. Send for catalog and samples or call your EVERLOCK representative.

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Division of
American Machine
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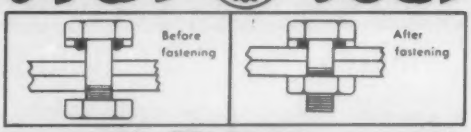

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NO-LEAKAGE SEALING

Stat-O-Seals offer superior features for sealing fasteners. The seal is under controlled confinement with full metal to metal contact to assure a positive, no-leakage seal at low or high pressures or vacuum. They are self-centering, provide a high re-usability factor, give longer service. Single, one-piece configuration provides fool-proof assembly, and quick, visual installation inspection; are economical in first cost as well as obtaining savings in safety and ease of installation.

Send for free catalog.

Parker SEAL COMPANY
Culver City, California and Cleveland, Ohio
A DIVISION OF PARKER-HANNIFIN CORPORATION

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manufacturing facilities in Chicago and Torrington, Conn.

Pheoll is a wholly owned subsidiary of Allied Products Corporation, Detroit. At present, Pheoll has manufacturing facilities in Chicago; Frankfort, Mich.; and Torrington, Conn.

BRAZING SEMINAR AT METAL SHOW

The Metal Treating Institute, national trade association of the commercial heat treating industry, will have an exhibit at the ASM Detroit Metal show. The 43rd Metal Congress and Exposition is being held in Cobo Hall, October 23-27th.

In addition, the 80-member companies comprising the Institute have agreed to be one of the ten organizations which will present technical sessions during the congress. The session will be held on Thursday morning, October 26. The program and panel will be:

"Can Your Costs be Reduced by Brazing Techniques?"
Moderator: Robert F. Gunow—Vac-Hyd Processing Corp., Detroit.
Speakers: Don C. Dilley—Ferrotherm Co., Cleveland.
"Hydrogen Brazing of Prototype Stainless Steel Fuel Elements for N.S. Savannah."
"Vacuum Furnace Brazing of Stainless Steels"
Ted H. Crane—Kinetics Corp., Hingham, Mass.
Richard L. Evans—Syracuse Heat Treating Corp., Syracuse, N.Y.
"Furnace Brazing of Steel Parts by Dissociated Ammonia"
N. K. Koebel & C. H. Ulrich—Lindberg Engineering Co., Chicago, Ill.
"Vacuum Brazing of Aircraft Alloys"
F. J. Fahrendorf—Handy & Harman, New York.
"Salt Bath Brazing of Aluminum"
R. Seal & D. W. MacVicar—Bi-Braze Corp., Brooklyn, N.Y.
"Brazing Ferrous Alloys to Aluminum."

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It's the most complete reference I have on grooved pins. Not only tells me about the extensive line of diameters, lengths, groove arrangements, steels, aluminums, brass, bronze and other pin metals available from Driv-Lok, but special pins as well.

It's got factual information on drilling procedures, tolerances, weights per thousand, minimum shear values for various metals, recommended pin diameters for various torque values, and a host of typical applications.

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Don't get hung up . . . from stealing or a tough fastening problem. Send for your Driv-Lok catalog today!

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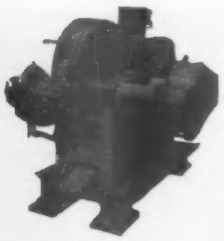

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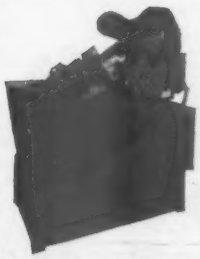

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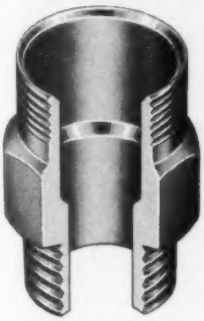

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Entire structure with 300-seat capacity is assembled on site.

18—Higher Priced Parts Cut Assembly Cost
Busway used costlier molded parts to reduce over-all cost.

20—Tape Selection of Weld Conditions
Provides variety of weld heats for microminiature assemblies.

22—Positioners Aid Electronic Work
Speeds the assembly of components for marine telephone systems.

24—Chilling Unit for Fitted Components
Expansion procedure overcomes problems in shrink-fitting.

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Like changing blades in a razor!

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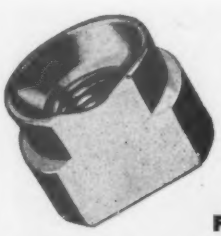

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Whether you use cold-headed Pipe Plugs, Weld Nuts, Machine Screws, Lag Bolts, Hex Nuts, Wing Nuts, Washers or special fasteners, Decker fasteners will add new efficiencies and economies to your manufacturing operations.

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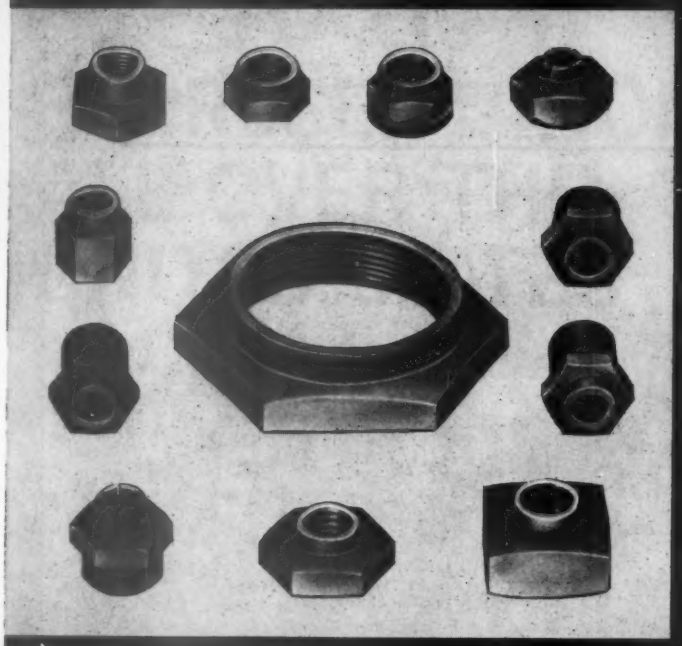
SPECIAL LOCKNUTS . . . *that solved fastening problems*



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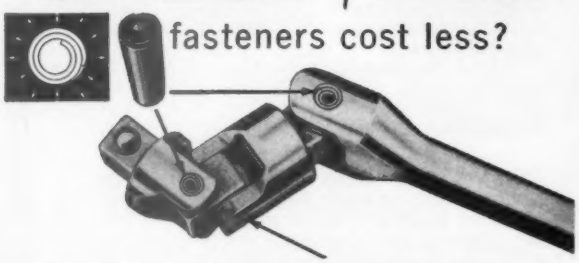
fasteners cost less?



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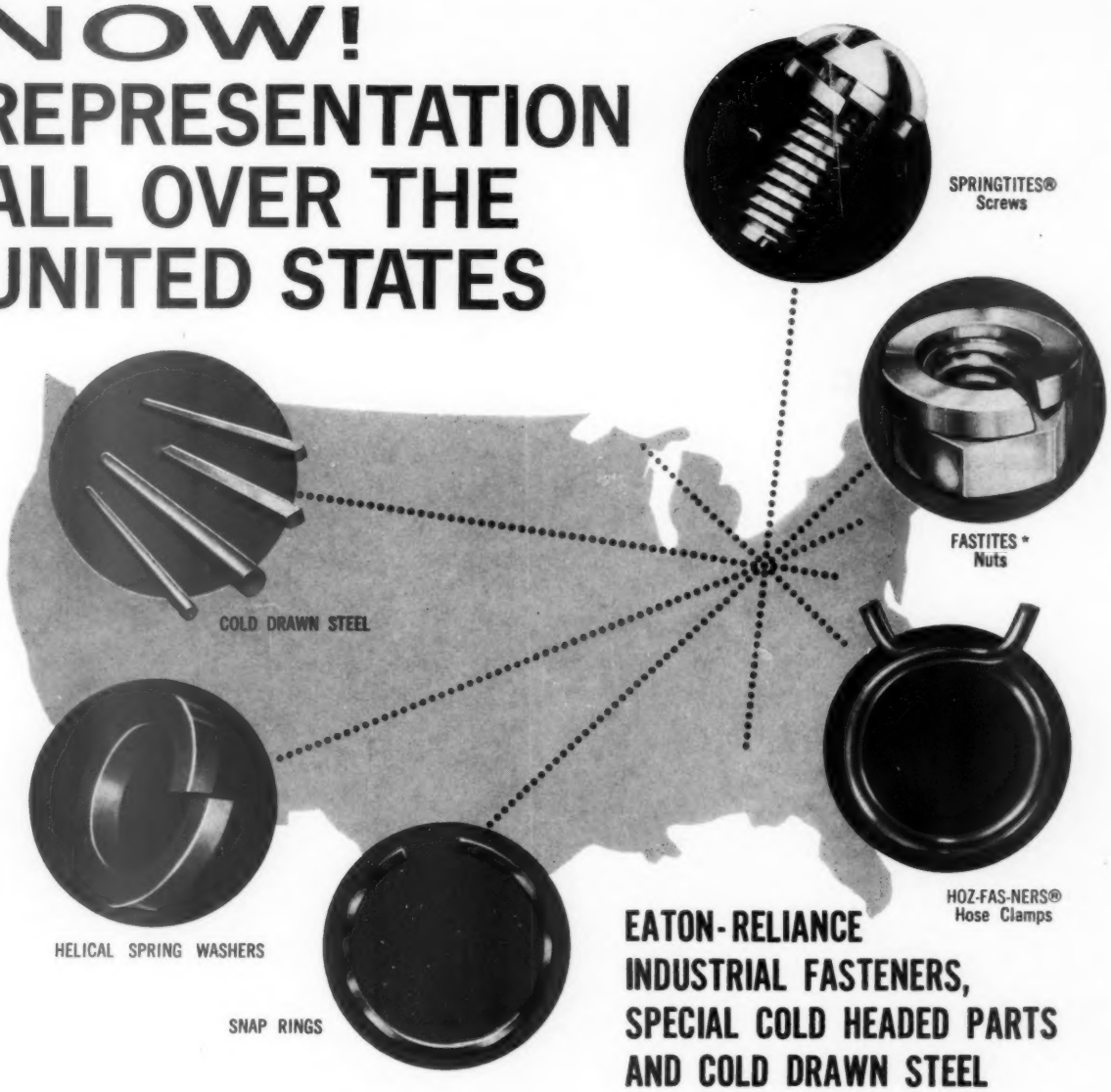

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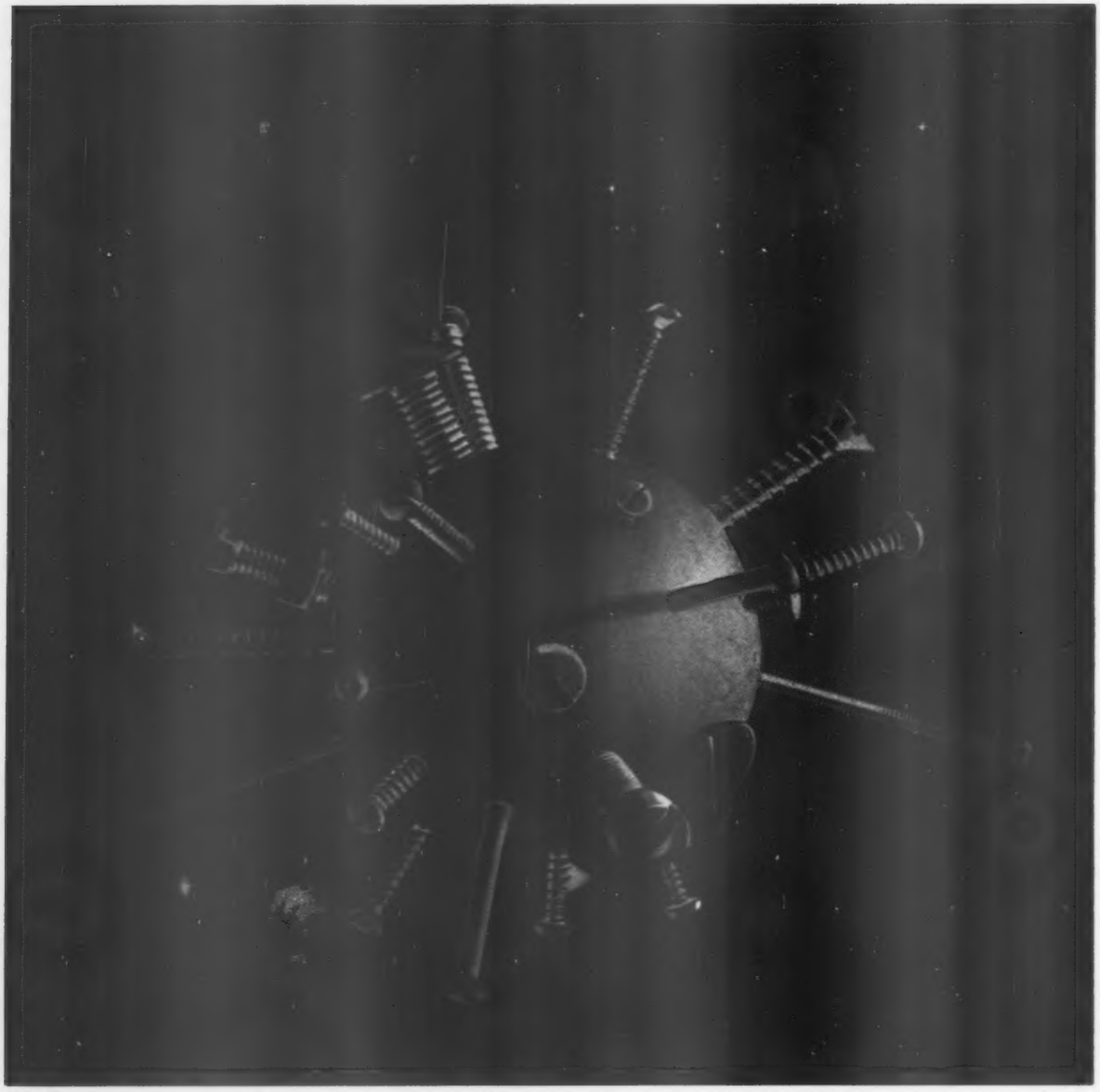

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